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EDITOR OF THE MONTH

EARL C. ELKINS, M.D.

Rochester, Minnesota

Printed in U.S.A.

APPROVED SCHOOLS FOR PHYSICAL THERAPY TECHNICIANS ‡

Council on Medical Education and Hospitals of the American Medical Association

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University of Kansas School of Medicine, Kansas City[1]	Donald L. Rose, M.D. Mrs. Ruth G. Monteith Miss Lilyan G. Warner	Univ. Kans.	a-b-c[2]	12 mos.	FebSept	20	$ 80[3]	Cert. or Degree
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University of Texas School of Medicine, Galveston[1]	G. W. N. Eggers, M.D. Miss Ruby Decker	Univ. Texas	a-b-d[8]	12 mos.[7]	Jan	6	$141[3]	Certificate
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University of Wisconsin Medical School, Madison[1]	Harry D. Bouman, M.D. Miss Margaret A. Kohli	Univ. Wis.	a-b-c[2]	12 mos.	Sept	20	$120[3]	Cert. or Degree
University Southern California, Los Angeles	O. L. Huddleston, M.D. Charlotte Anderson	Univ. of S. Calif	d[2]	12 mos.	Sept	16	$374	Certificate
Albany Hospital, Albany, N. Y.	John Ghormley, M. D. Catharine Graham	None	a-b-c	12 mos.	Sept	6	$200	Certificate
Mayo Clinic Section on Physical Medicine, Rochester, Minnesota	Frank H. Krusen, M.D. Miss Ruth Ryan	None	a-b-c	12 mos.	July	20	none	Certificate
Children's, Massachusetts General, Peter Bent Brigham Hospitals	William T. Green, M.D. Arthur L. Watkins, M.D. Miss Janet B. Merrill	School of Science Simmons College	a[9]-b[9]-d-e[10]	16 mos.	Sept	25	$550	Diploma or Diploma and Degree[10]
University of Colorado Medical Center, Denver, Colorado[1]	Harold Dinken, M.D. Miss Mary Lawrence	University of Colorado Medical Center	a-b-d	12 mos.	JanSept	Varies	$300[3]	Certificate

* Courses are so arranged that any of the entrance requirements will qualify students for training. a = Graduation from accredited school of nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; e = Four years of College with science courses; H. S. = High school graduation; f = degree in physical education or sciences.

† Currently eighteen Navy nurses are enrolled in a six-month emergency course.

1. Male students admitted.
2. High school graduates admitted to four-year course leading to degree.
3. Non-residents charged additional fee.
4. High school graduates admitted to four-year course leading to degrees from Tufts College.
5. Tuition for degree course is $400 per year.
6. College graduates admitted to twelve month certificate course.
7. Effective 1947 class.
8. Effective 1948 class.
9. With adequate science courses.
10. High school graduates admitted to four and one-half years course leading to degree from Simmons College.

‡ Reprinted in part J. A. M. A. 133:1140 (April 12) 1947.

** At the end of nine months the students can register in the graduate school for a degree of master of science in [illegible]

THE USE OF THE STEWART CALORIMETER IN PHYSICAL MEDICINE *

SOPHIA ERNST, M.S., R.P.T.T.

G. K. STILLWELL, B.A., M.D.

and

ALLAN HEMINGWAY, Ph.D.

MINNEAPOLIS

In physical medicine the beneficial effects of heat therapy and massage are attributed to their influence as stimulants of blood flow. In the past, the increased blood flow following a treatment has been estimated by the general appearance, the sensation of warmth and the decrease of pain in the area treated. More exact quantitative methods are needed in physical medicine to determine changes in blood flow caused by various modes of treatment. When such information is available, the physiatrist will be better able to choose the correct form of therapy for a particular condition.

There are five ways which have been generally used to measure changes in blood flow in an extremity. These are (*a*) the skin temperature method, (*b*) the venous occlusion plethysmograph, (*c*) the pulsation plethysmograph, (*d*) the photoelectric plethysmograph and (*e*) the Stewart calorimeter. Each has its advantages and disadvantages.

We investigated the usefulness of the Stewart calorimeter as a means of measuring changes in peripheral blood flow for three principal reasons: 1. The Stewart calorimeter is simple in construction, with no elaborate apparatus being required. 2. It is simple in operation and, once set up in the laboratory, can be operated by a well trained technician. 3. The Stewart calorimeter, in comparison with other methods of measuring changes in peripheral blood flow, requires a minimum amount of time, of both patient and operator; hence has possibilities as a clinical instrument which can be used routinely in estimating the value of methods of treatment used in physical medicine to increase peripheral circulation.

The Stewart calorimeter as used at the present time differs only in slight detail from that described by Stewart[1] in 1911. The hand (or foot) is immersed in the calorimeter bath ten minutes before initial readings are taken. This consists of a 3 liter vessel, well insulated thermally from the surroundings, and containing a stirrer and an electrical resistance thermometer. The temperature increase of the water in the calorimeter is measured during a ten minute interval. Correction is made for heat loss to the surroundings. The rate of heat loss from the hand to the water is measured and expressed in gram calories per hundred cubic centimeters of hand per minute.

Stewart believed this method could be used to measure in absolute units of cubic centimeters per minute the amount of peripheral blood flow. This computation involved the assumption that venous blood returning to the heart from an extremity was at the same temperature as the bath. This assumption is not valid, as shown by Harris and Marvin,[2] who measured peripheral venous temperatures. Hence absolute peripheral blood flow is no

* From the University of Minnesota.
* Aided by a grant from the Baruch Committee on Physical Medicine.
* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 3, 1947.

1. Stewart, G. N.: Studies on the Circulation in Man, Heart 3:33 (Oct. 30) 1911.
2. Harris, K. E., and Marvin, H. M.: The Temperature of Venous Blood and Its Use in Estimating Rate of Blood Flow to the Hand, Heart 14:49 (April) 1927.

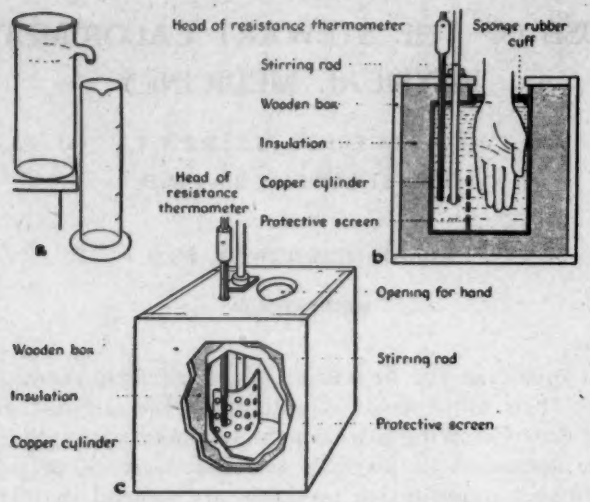

Chart 1. — (*a*) Overflow vessel for determination of hand volume; (*b*) schematic drawing of calorimeter with hand inserted; (*c*) cutaway drawing of calorimeter.

longer computed from measurements made with the Stewart calorimeter. Instead, the rate of heat exchange is measured and used as an index for estimating changes in blood flow rate. Sheard,[3] Kegerreis[4] and Brown[5] used the method clinically and demonstrated striking changes in peripheral blood flow in cases of thromboangiitis obliterans, sympathectomy and polycythemia vera. Brown recommended the instrument as a useful clinical aid in measuring changes in peripheral blood flow.

In order to determine the condition most suitable for clinical use of the Stewart calorimeter in physical medicine, a number of preliminary measurements were made. Heat loss rates from hand to water were made at three environmental temperatures of 35, 25 and 15 C. and in each of these envi-

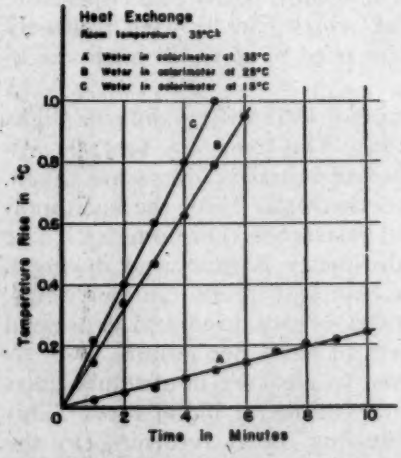

Chart 2. — Graphic representation of rate of heat exchange between hand and water in room temperature of 35 C. The curves show the rate of rise of the temperature of the water in the calorimeter.

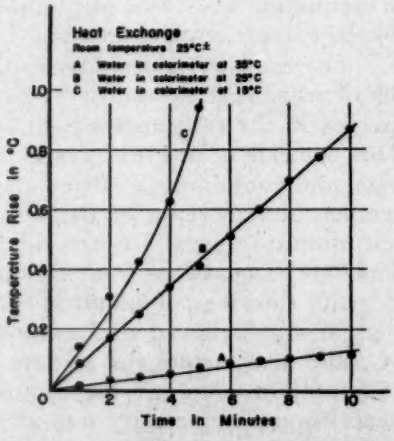

Chart 3. — Graphic representation of rate of heat exchange between hand and water in room temperature of 25 C.

3. Sheard, C.: Calorimetric Studies of the Extremities: I. Theory and Practice of Methods Applicable to Such Investigations, J. Clin. Investigation 3:327 (Dec.) 1926.
4. Kegerreis, R.: Calorimetric Studies of the Extremities: II. Experimental Apparatus and Procedures, J. Clin. Investigation 3:357 (Dec.) 1926.
5. Brown, G. E.: Calorimetric Studies of the Extremities: III. Clinical Data on Normal and Pathological Subjects with Localized Vascular Disease, J. Clin. Investigation 3:369 (Dec.) 1926.

ronments with water temperatures of 35, 25 and 15 C. The results are shown in table 1. It will be observed that, with water temperature at 35 C. for the three environments (which may be designated as warm, comfortable and cold)

TABLE 1. — *Heat Loss Rates from Hand to Water.*

Group	Room Temp., C.	Water Temp., C.	Av. Cal./100 C.C. /Min.	Range Between Extremes of Group, Cal.
I	35	35	24.9	5.18
II	35	25	137.6	16.1
III	35	15	203.35	32.07
IV	25	35	28.82	8.38
V	25	25	98.14 114.00*	13
VI	25	15	128.68	91.15
VII	15	35	7.6	1.3
VIII	15	25	35.96	26.45
IX	15	15	58.16	38.29

* Reading taken under basal conditions.

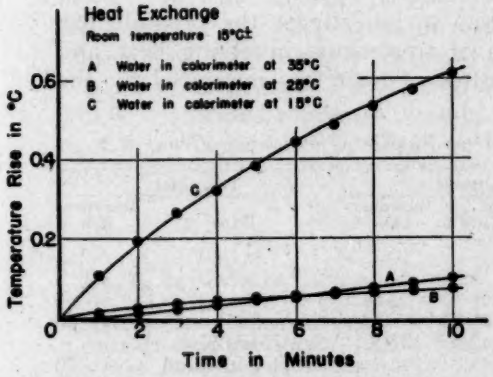

Chart 4. — Graphic representation of rate heat exchange between hand and water in room temperature of 15 C. Curve A — with water temperature of 35 C. (Group 7). Curve B — with water temperature of 25 C. (Group 8). Curve C — with water temperature of 15 C. (Group 9).

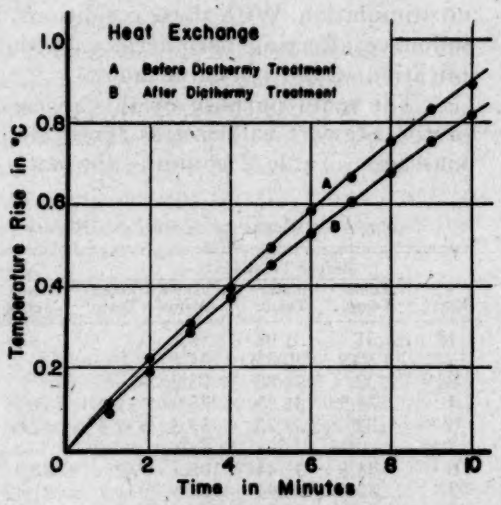

Chart 5. — Graphic representation of the rate of rise of the temperature of the water in the calorimeter upon immersion of the hand before and after diathermy.

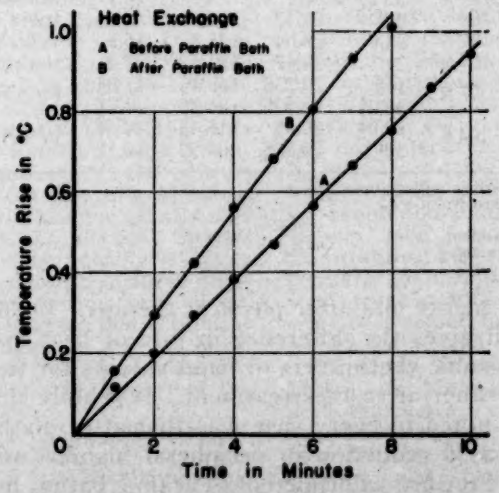

Chart 6. — Graphic representation of the rate of rise of the temperature of the water in the calorimeter before and after treatment with the paraffin bath.

the rate of heat loss was small. This was due to the small difference in temperature between blood and water — 37 and 35 C. — which would tend to reduce heat flow. With a water temperature of 25 C., there was a striking difference between rates of heat loss for a warm, a comfortable and a cold environment. In a warm environment, where reflex vasodilation is effective, the rate of heat loss was 137 calories per cubic centimeters per minute. In the comfortable environment, the rate of heat loss was 98 and 114 calories. In the cold environments, where reflex vasoconstriction was effective, the rate of heat loss was 36 calories per hundred cubic centimeters per minute. Similar differences were noted with the cold water, also. These results show that for comparable values for estimating blood flow changes, the environmental temperature and water temperature must be controlled. It is suggested that an environmental temperature of 25 C., with water temperature between 25 and 30 C., be used for the hand and an environmental temperature of 30 C. with water temperature of 30 C. be used for the foot. This environment is comfortable, and the water temperature is close to the "neutral" temperature, where warmth and cold nerve reactions receive little or no stimulation. With these conditions, there would be minimum reflex nervous influence affecting peripheral vasoconstriction or vasodilation and this complication would not be a factor.

The main purpose of this research was to investigate the possible use of the Stewart calorimeter for evaluation of treatments involving heat and massage. Table 2 contains the data of rates of heat loss measured by the

TABLE 2. — *Rates of Heat Loss Before and After Physical Therapy — (Group X.)*

	Before Treatment			After Treatment				Treatment	
Exp.	Room Temp.	Water Temp.	Cal./100 Cc. /Min.	Room Temp.	Water Temp.	Cal./100 Cc./Min.	Increase, Cal.	Type	Duration, Min.
1*	31	31.08	53.1						
2†	.....30.5	30.35	32.4						
3‡	32	31.85	73.2						
4	.....31.5	31.59	75.94	31.9	31.74	71.33	—5.64	S. W. diathermy	20
5	32	31.73	53.3	32.3	32.08	42.8	—10.5	S. W. diathermy to opposite hand	20
6	.....31.5	31.44	108.5	32	31.9	83.3	—15.2	S. W. diathermy	20
7	.....31.5	30.83	115.6	31.7	31.47	110.4	—5.2	S. W. diathermy	20
8	.....31.9	31.5	84.14	32.2	31.6	65.5	—18.64	S. W. diathermy	20
9	.....32.2	31.88	101.9	32.5	31.68	91.5	—10.4	S. W. diathermy	20
10	31	30.08	97.9	31.2	30.62	82.4	—15.5	S. W. diathermy	20
11	.....33.4	32.8	74.4	33.2	32.7	79.1	4.7	Massage	20
12	28	28.8	106	29	28.12	115	9	Infra-red radiation	30
13	.....28.7	28.48	109	28.9	28.64	125.3	16.3	Whirlpool bath (44 C.)	
14	.....29.5	29.56	107.07	29.5	28.67	114.48	7.41	Paraffin bath (50 C.)	
15	30	29.1	97.9	30§	29.23§	145.4§	—47.9§	Paraffin bath (54 C.)	25
				30.2¶	29.32¶	96.2¶	—1.7¶		
16	.....29.8	29.32	104.6	29.9§	29.4§	115.4§	10.6§	Whirlpool bath (41 C.)	20
				30¶	29.16¶	104.5¶	—0.1¶		

* Patient had arteriosclerosis and diabetes.
† Patient had arteriosclerosis.
‡ Child aged 7.
§ Immediately after treatment.
¶ Two hours after treatment.

Stewart calorimeter before and after physical therapy. Of particular interest is the column which gives the difference in rate of heat loss in calories per minute per hundred cubic centimeters of hand volume for two measurements, one before and the other after the treatment. A wholly unexpected finding and one which was noted in every case was that after diathermy treatments of the arm there was a reduction in peripheral blood flow of the hand, as determined by the Stewart calorimeter. Paraffin baths, massage, infra-red radiation and whirlpool baths produced a directly opposite effect. These

modes of therapy all result in an increased peripheral blood flow. However, two hours after a paraffin bath the peripheral blood flow had returned to normal.

Comment and Conclusion

It has been suspected that diathermy as a method of heat treatment differs from other forms of heat treatment. According to physical principles, diathermy produces heat electrically within the tissues, while baths, infra-red treatment and massage warm selectively the peripheral tissues. However, apart from showing a different distribution of temperature as a result of the two forms of therapy, exact quantitative physiologic differences between these two types of treatment were difficult to demonstrate. In the experiments listed in table 2, the results show striking differences between diathermy and the other forms of therapy investigated. When diathermy is applied to an area, the peripheral blood flow is reduced, indicating, possibly, a shifting of blood from peripheral to deeper tissues. Baths, massage and infra-red radiation, on the other hand, stimulate blood flow in the peripheral tissues.

In conclusion, when the Stewart calorimeter is to be used as an instrument to indicate changes in peripheral blood flow, it is recommended that the most satisfactory conditions for operation are a room temperature of approximately 25 C. and a water temperature between 25 and 30 C. for the hand and a room temperature of 30 C. and a water temperature of 30 C. for the foot. These conditions represent a comfortable environment for the patient and a local environment for the hand or foot which produces minimum reflex vasomotor effects.

Discussion

Dr. S. L. Osborne (Chicago): This is an excellent paper and certainly well presented, and anything which can add to information on peripheral blood flow in physical medicine is certainly of value. However, I wonder if this is as simple a problem as the authors have made it appear. I think the question of blood flow is a rather difficult problem, and I wonder if it can be made simple.

The calorimeter of Stewart is based on two assumptions: The first is that the hand is a perfect radiator when it is immersed in a small volume of water (3,000 cc.), the blood coursing through its vessels gives off heat, so that the temperature of the hand is the same as the temperature of the surrounding water provided the environmental temperature of the skin is above 25 C. It has been shown by the classic research of Hardy, DeLorme, Hardy and Soderstrom and by the work of Stewart and Jack that the skin probably is pretty nearly a perfect insulator, equivalent probably to cork. The second assumption, which has been questioned and I think it is worthy of questioning, is that the blood is the only source of the heat, the heat generated by the muscular tissues of the hand being negligible.

I am sorry that I didn't get an opportunity of having this paper to study carefully. I went over it hastily this morning, and it seems to me the problem has been over simplified.

Hardy has shown that to get accurate peripheral blood flow studies you must get the average temperature of the body. That means, he says, you must record temperatures from not less than eleven sections of the body. The essayists should tell us if skin temperatures are determined and where. A second factor is that the patient should be in a basal state and basal metabolism should be taken into consideration. The third factor, modified from DeLorme and Hardy by Stewart and Soderstrom, is that the weight of the patient should be given consideration and that the rectal temperature and skin temperature weighted against the others—the skin temperature given a weight of 20 per cent and the rectal temperature given a weighing of 80 per cent — so that the average temperature is a complicated factor.

I should like to ask the essayists whether they took into cognizance the rectal temperatures, how closely the room temperature was maintained, whether any factors of radiation were taken into consideration, whether the convection currents were a factor, and so on.

Dr. M. B. Ferderber (Pittsburgh): In 1938 at the University of Pittsburgh, we used the Stewart calorimeter in studying skin temperatures. We were fortunate to have Dr. Rogoff, formerly associated with Stewart, and made instruments copied from the original. The calorimeters were used primarily to establish the accuracy

of the skin thermocouple and oscillometer in vascular diseases.

It is interesting that adults with arteriosclerosis frequently had high oscillometric readings but low skin temperatures, in contrast with young healthy medical students, who frequently showed lower oscillometric indexes. Using the Stewart calorimeters, we were able to demonstrate that the blood volume was higher in the young individuals, despite the oscillometric readings being greater in the older group. This anomaly can be explained by the loss of tissue and sclerosis of the older group, and therefore an entirely false basis for accurate diagnosis becomes readily evident.

We used a room with controlled wet and dry bulb temperatures so that our gradients were constant. By permitting the patients to lie quietly in this conditioned enclosure, the factor of emotional states which frequently cause changes in skin temperatures was eliminated. The effects of air motion on skin temperatures are well known since the factor of evaporation is greater where there is motion of the ambient atmosphere.

Dr. Julia Herrick (Rochester, Minn.): My question is largely a repeat of the last statement. What is the sensitivity of this method of measuring? Would you consider that variation due to diathermy really significant?

Dr. William Bierman (New York, N. Y.): Would it be possible to correlate intramuscular and subcutaneous temperature measurements? We have been troubled with this difficulty of differentiating between changes in circulation of skin and tissues beneath the skin. We evaluated the results following sympathectomy of the lower extremities by the use of temperature determinations. This method does give us some indication of the relative changes in skin circulation and in the muscles. Following sympathectomy, we found there was no elevation in the temperature of the muscles while dilation of the skin and elevation of its temperature did occur. If there be any relation between temperature and blood flow, and we think that ordinarily there is, then our work would indicate that while the plethysmograph might show a gross volume change in the entire extremity this need not necessarily be due to an increase in blood flow in the muscles of the lower extremities.

Dr. S. L. Osborne (Chicago): I would like to know whether the skin temperatures were taken by radiometric methods or thermocouples. I think thermocouple measurements of the skin are far from accurate. For instance, the pressure if variable will change the deflections of the galvanometer. Secondly, if you bind the couple on in place, then you prevent radiation from the spot. I think that is important.

Was the temperature of the room taken into consideration, and if so, within what limits and whether any provision was made for the radiation from the calorimeter itself.

Sophia Ernst (closing): Experiments for radiation loss and water equivalent were performed preliminary to the experiments on heat exchange. The values obtained in these experiments were added to the final calculations for heat exchange.

Our formula was different from that used by Stewart in 1911, who claimed that he measured blood flow directly. Stewart considered the rectal temperature to be the same as the arterial temperature and he considered the temperature of the venous blood flow returning to the heart from the hand as being the same as the average temperature of the water in the calorimeter. Skin temperatures and rectal temperatures were not taken with our experiments.

Dr. Allan Hemingway (Minneapolis): Regarding skin temperature, we assumed with Burton and Bazett and others that the skin temperature is bath temperature. On the question of radiometer and skin temperature, Dr. Stillwell has been making a number of investigations checking the radiometer temperature against thermocouple temperature and he will report these results later.

EVALUATION OF AIDS TO MUSCLE REEDUCATION IN THE TREATMENT OF POLIOMYELITIS *

FREDERIC J. KOTTKE, M.D., Ph.D.
BARBRO S. TEIGEN, B.S., R.P.T.
SHELDON SIEGEL, M.D.
and
MILAND E. KNAPP, M.D.

MINNEAPOLIS

Since the importance of muscle spasm and muscle shortening in acute poliomyelitis has been recognized, a number of methods of obtaining relaxation have been advocated. The primary requisite in all these methods is early mobilization of the shortened muscles. The measures which are reported to facilitate early mobilization include hot foments (Kenny[1]), hot tub baths, prostigmine (Kabat and Knapp[2]), and curare (Ransohoff[3]). Recently Ransohoff[3] has reported that on a regimen intramuscular injections of an aqueous solution of curare and stretching of all involved muscles there was dramatic relief of pain and muscle spasm, with return of muscles to their normal resting length. This treatment with curare has been reported to make possible the use of physical therapy which otherwise could not be tolerated and therefore to be superior to any form of therapy described previously. A further advantage of the advocated curare treatment is that its simplicity makes it easier and more economical to use than the treatment with hot packs if the same results can be obtained. However, Fox[4] could not demonstrate appreciable subjective improvement in a series of 32 patients with acute poliomyelitis treated with single injections of aqueous curare. Both Fox and Ransohoff have estimated the value of treatment with curare by clinical impression, without comparing results with those in a control group run simultaneously. Therefore, in the epidemic in Minnesota in 1946 an attempt was made to evaluate objectively the use of hot foments or curare as adjuvants to the standard physical measures employed by us in treating acute and subacute poliomyelitis. As a control for both of these adjuvants, saline placebos and/or the standard physical measures were employed on a third group of patients.

Methods

This study was carried out in the special poliomyelitis ward of the pediatric service, to which patients up to the age of 16 years were admitted. To insure the best possible cooperation from the patients, no patients under the age of 9 years were included in the study. Patients were assigned to the various test groups at random, without regard to their degree of involvement. The treatment was begun on patients in this study as soon as they were admitted to the hospital and within two weeks of the onset of the disease. All patients were kept on a standard poliomyelitis bed[1] with felt mattress, bed boards and footboards. During the acute phase of the disease when they would be quiet, during hot packing and while resting, the patients were encouraged to maintain the supine anatomic position with the soles firmly against the footboards.

* From the Division of Physical Medicine and the Department of Pediatrics, University of Minnesota Hospitals.
* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 5, 1947.

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2. Kabat, H., and Knapp, M. E.: The Mechanism of Muscle Spasm in Poliomyelitis. Staff Meet. Bull. Univ. of Minnesota Hosp. 14:359, 1944.
3. Ransohoff, N. S.: Curare in the Acute Stage of Poliomyelitis, J. A. M. A. 129:129, 1945; Curare and Intensive Physical Therapy in the Treatment of Acute Anterior Poliomyelitis, Bull. New York Acad. Med. 23:51, 1947.
4. Fox, M. J.: Curare in the Treatment of Acute Poliomyelitis, J. A. M. A. 131:278, 1946.

In the convalescent stage of the disease, activity was not discouraged. The general care, including hot packs, for the study group was the same as that administered to all other patients on the wards.[5]

The physical therapy methods employed were those that have been used and developed in Minneapolis over the last five years by Knapp and his associates.[6] All muscles showing decrease in normal length on relaxation were stretched routinely twice daily by the physical therapist. Stretching was begun gently in the acute phase of the disease and was increased in intensity as rapidly as the patient's condition would tolerate. Stretching was carried past the point of pain but stayed below the point at which residual pain would remain after stretching. In addition, each patient was given stretching exercises to do by himself or with the aid of a companion several times daily. This regimen was continued until the muscles had regained their normal length. Tightness or limitation of motion was measured under standard conditions daily throughout the period of the experiment. Angles of motion were measured with a goniometer with 10 inch arms and distance with a centimeter tape. The following measurements were found to be most useful as indications of muscle shortening:

1. Straight leg raising (passive) — angle from the surface of the table or bed through the long axis of the femur
2. Forward neck flexion (passive) — angle from the bed
3. Hairline to knee distance in sitting position with knees extended.

All measuring was done by the same physical therapist in an attempt to maintain standard conditions.

The hot packs used were the standard Kenny hot packs, heated in boiling water and centrifuged damp dry. Each patient received six sets of wrap packs to all tight muscles daily or four sets of wrap packs and two "sets" of prone packs. A "set" of prone packs consisted of a pack from neck to heels, applied three times at ten minute intervals. Other than standardization of the number of packs per day, the hot packing was the same as received by all other poliomyelitis patients.

The use of curare was modified slightly from that described by Ransohoff.[3] Aqueous Intocostrin was used as the curare preparation throughout this study. An initial test dose of 0.9 unit per kilogram of body weight was injected to rule out hypersensitivity. Then the subsequent doses were increased to 1.5 units per kilogram. (Several patients developed toxic symptoms with this dose, which made it necessary to decrease it slightly.) The curare was injected intramuscularly into the buttock twice daily. Because of residual pain and tenderness at the site of injection, 0.5 cc. of 1 per cent procaine hydrochloride solution was added to the Intocostrin. Forty-five minutes after the injection, the patients were stretched and measured.

The injections of the saline and procaine placebo were given at the same time and with the same routine as that used for curare. All patients receiving injections believed that they were receiving curare. Two patients were treated for muscle shortening by stretching alone. In the analysis for the data they have been included in the placebo group.

Results

In the table are summarized the results on 17 patients ranging in age from 9 to 15 years. Of this group, 5 received only stretching or placebos and stretching, 4 received hot foments plus stretching, and 8 received intramuscular curare plus stretching. Within these groups, patients were classified as paralytic and nonparalytic on the following basis: If strength of the muscles appeared normal at or before the time that there was no longer shortening in the antagonists, the patient was considered nonparalytic. In practically every patient in the acute stage of poliomyelitis when flexion of the neck or back produced pain, the anterior neck and abdominal muscles appeared weak. However, these muscles apparently regained their strength as soon as normal muscle length in the antagonists was established. In all three groups, the nonparalytic patients, as a rule, regained their normal resting muscle length more quickly than the paralytic patients. In most cases, establishment of mobility in the muscles of the back and thighs as indicated by touching the hair line to the knees required the longest time.

5. Grules, C. G., Jr., and Panos, T. C.: "Acute Poliomyelitis in Children." Staff Meet. Bull. Univ. of Minnesota Hosp. 18:251-61, 1947.
6. Knapp, M. E.: Treatment of the Muscular After-Effects of Poliomyelitis, Arch. Phys. Med., to be published.

The variation of time necessary for return to normal range of motion was from fourteen to twenty-eight days for nonparalytics and from twenty-two to more than seventy-five days for paralytic patients. With all three types of treatment, the time necessary to establish normal mobility appeared to be within the same range. Nonparalytic muscles, regardless of the adjuvant to stretching, regained normal length in two to four weeks. Most of this increase occurred in the first few days (fig. 1).

In the paralytic patients the increase of muscle length was slower and more erratic. Often there was considerable day to day variation in resting muscle length (fig. 2). Nevertheless, there was a gradual decrease of muscle tightness, with the result that eventually normal resting muscle length

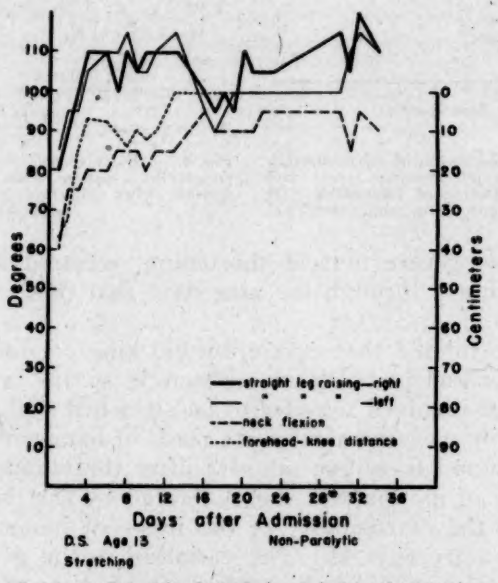

Fig. 1. — Rate of relief of shortening in the muscles of the neck, back and hamstrings of a patient with nonparalytic poliomyelitis, with return of all muscles to their normal resting length when treated by stretching alone.

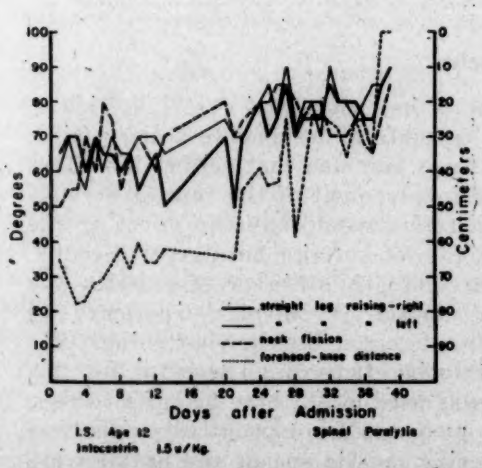

Fig. 2. — Rate of relief of shortening in the muscles of the neck, back and hamstrings of a patient with severe paralytic poliomyelitis when treated by intramuscular injections of Intocostrin and stretching.

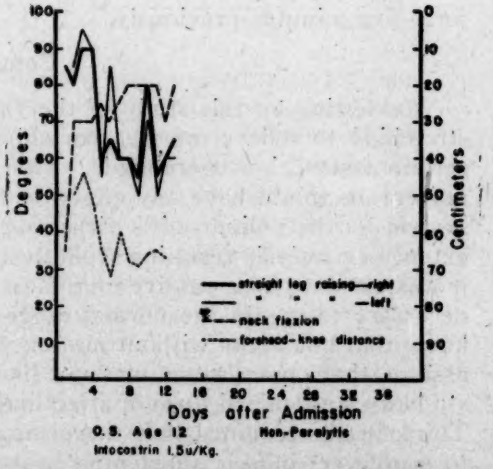

Fig. 3. — Development of tightness in the back and hamstring muscles of a patient early in the course of poliomyelitis while being treated by intramuscular Intocostrin and stretching.

was attained. Again, adjuvants to stretching appeared to have no marked effect.

In one case (fig. 3) the patient was admitted to the hospital before there was appreciable tightness in the hamstring muscle groups, and Intocostrin therapy was started immediately. Four days later, in spite of continued

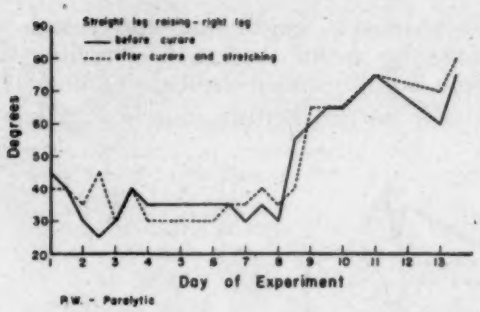

Fig. 4. — Daily record of the length of the hamstring muscles of a patient with poliomyelitis before and forty-five minutes after injection of Intocostrin (1.5 units per kilogram) intramuscularly and stretching.

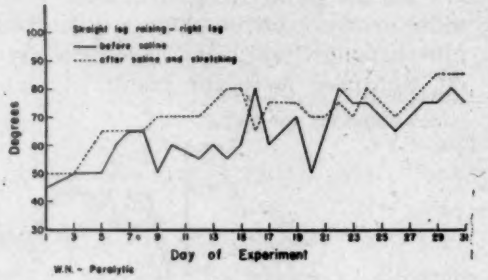

Fig. 5. — Daily record of the length of the hamstring muscles of a patient with poliomyelitis before and 45 minutes after injection with saline intramuscularly and stretching.

Intocostrin therapy, severe muscle shortening occurred in the hamstrings and back and continued through the nine days that this patient remained in the hospital.

It has been postulated that curare, by blocking conduction of nerve impulses at the motor end plate, decreases muscle spasm in poliomyelitis and therefore allows the involved muscles to be stretched without pain. To test this hypothesis, daily measurements were made of hamstring length (straight leg raising) before and forty-five minutes after the curare was given. The end point of range of motion was that tolerated by the patient due to pain. It was found that the extensibility of the involved hamstring muscles was not increased by curare (fig. 4). The variation in the goniometer readings from day to day was usually within the range of error of the method. Patients receiving the saline placebos also were measured in the same manner (fig. 5). These patients showed, if anything, a greater pain in muscle length after the injection than the patients receiving curare. This increase in muscle length is probably what might be expected as the result of a stretch forty-five minutes previously.

Comment

In setting up this study of the value of hot packs and curare as aids to stretching to relieve muscle shortening in acute and subacute poliomyelitis, certain assumptions were made. First, it was assumed that neither hot packs nor curare would have any effect on the involvement of the central nervous system by the poliomyelitis virus and therefore would have no effect on the extent of paralysis resulting from destruction of anterior horn cells. Second, it was assumed that passive motion or stretching of all involved muscles was necessary to regain the normal range of motion. From past experience we know that hot packs without motion will not relieve muscle shortening. We assume that curare alone was not likely to be effective. Therefore, for this study a standardized form of stretching was used in all three groups of cases. Third, it was assumed that the primary purpose of hot packs or curare was to counteract muscle shortening by relieving muscle spasm and by allowing more intensive stretching to return the shortened muscles to their normal resting length. Attainment of this normal motility is necessary to prevent

the fixed deformities which so often have been the end result of poliomyelitis in the past. To this end, the criterion for evaluating these adjuvants was the time necessary to achieve a standardized normal range of motion in the muscles most commonly affected by poliomyelitis.

Undoubtedly there are several causes of muscle shortening in poliomyelitis. In the acute phase of the disease, muscle pain at rest is a contributing factor causing muscle spasm or splinting in an effort to relieve the pain. Relief of this pain will help to relieve muscle spasm, and, conversely, relief of spasm diminishing pain. Positioning the patient so that the muscles in spasm are not under tension will often relieve the pain for as long as that position is maintained. This is not possible if there is widespread involvement and

The Effect of Various Treatments on the Reduction of Tightness in Poliomyelitis Patients.

Treatment, Patient and Age (Year)	Time in Days After Admission to Hospital * Straight Leg Raising to 90° Right	Straight Leg Raising to 90° Left	Neck Flexion to 90°	Touch Forehead to Knee	Type of Poliomyelitis
Stretching —					
D. S. —13	2	2	14	13	Nonparalytic
B. F. — 9	21	21	12	17	Nonparalytic
Placebo (saline) and Stretching —					
B. H. — 9	4	4	7	7 (45 cm.)	Nonparalytic
D. H. —15	52	52	16	42	Spinal paralytic
W. N. —13	63	63	59	73 (10 cm.)	Spinal paralytic
Curare and Stretching —					
W. M. —15	6	7	21	28	Nonparalytic
O. S. —12	13 (65°)	13 (60°)	13	13 (58 cm.)	Nonparalytic
S. C. —13	7	4	12	24 (41 cm.)	Spinal paralytic
J. D. — 9	16	25	25	32 (16 cm.)	Spinal paralytic
I. S. —12	39	39	60	38	Spinal paralytic
C. R. — 9	39	39	34	64 (18 cm.)	Spinal paralytic
J. R. —15	56	55	16	70 (10 cm.)	Spinal paralytic
P. W. —15	59	59	21	75 (15 cm.)	Spinal paralytic
Kenny Hot Packs and Stretching —					
M.J.R. —14	2	2	7	7 (13 cm.)	Nonparalytic
J. E. —13	6	6	9	18	Nonparalytic
E. D. —12	7	7	20	22	Spinal paralytic
R. F. —14	40 (40°)	40 (70°)	38	40 (56 cm.)	Spinal paralytic

* Figures in parentheses indicate distance in centimeters or angle in degrees on day of discharge.

is dangerous under any condition, as it provides optimal opportunity for fixed deformities to develop. Acetylsalicylic acid is of little value for severe muscle spasm, and narcotics are contraindicated because of the possibility of respiratory depression. Hot packs have been found to give relief of pain at this stage. Curare also is reported to be effective here. More surprising, gentle stretching alone was often found to give relief from pain. Regardless of the treatment given, in a matter of days the patient no longer had pain at rest but only when the shortened muscles were put on stretch. The greater the motion maintained in the muscles during the acute phase, the greater now was movement without pain.

At this time the onset of pain on extension of the muscle was at a definite point and was associated with involuntary activity of that shortened muscle, unless the muscle was completely paralyzed. It is probable that this pain on extension is due to tension on nerve endings bound in fibrous tissue built up in the muscle while it was in a shortened position. That such fibrosis or shortening of a muscle is not peculiar to poliomyelitis is common

knowledge. It occurs under all conditions in which a muscle maintains a fixed position for a period of time. Binding together of muscle fibers in the shortened position by the fibrous tissue prevents normal extensibility, and tension on pain endings produces pain of the same sort that is produced when a normal muscle is overstretched. Movement within the range of pain was entirely free, as it is in a normal muscle. It appeared that this second type of muscle shortening was of the greater importance in treating these patients, and much more time was spent in overcoming this type of shortening than in overcoming muscle spasm. Therefore, by our criteria, we were evaluating principally the factors of importance in overcoming "fixed" muscle shortening.

Because of the limitation of available personnel during the epidemic and the need for careful observation of all patients included in this study, it was necessary to limit the number of patients included in this study. Since the involvement of the nervous system by poliomyelitis varied greatly from one patient to the next, the series was not large enough to determine on a statistical basis the relative value of hot foments and aqueous intramuscular curare as aids to stretching to relieve muscle shortening. However, certain observations appear pertinent.

There was no apparent difference in the time necessary to attain standard motility in these children with poliomyelitis using hot packs, intramuscular aqueous curare or saline placebos as adjuvants to stretching. Insofar as possible, all other factors were kept constant in the three groups. Special emphasis was laid on keeping the stretching and activity of the patients at as near the same level as possible. This observation was unexpected in that the study was set up to evaluate curare versus hot foments as adjuvants to stretching on the assumption that both were of definite value.

Treatment of the skeletomuscular symptoms of acute poliomyelitis with curare is based on the presumption that, by blocking motor nerve impulses, curare relieves muscle spasm. This, in turn, should allow an increased range of motion in the involved muscle. By measurement it was found that curare caused no increase in the extensibility of the posterior thigh muscles in which there was marked muscle shortening due to poliomyelitis. It should be emphasized that this quantity of curare used without beneficial effect was great enough to cause diplopia, severe respiratory paresis and often prostration. It appears that doses of curare large enough to cause complete peripheral muscular paralysis and relaxation would also cause respiratory paralysis. In addition, it was observed that patients receiving curare were more apprehensive of stretching because they could more easily be hurt. In spite of the fact that they tried to be cooperative, they resisted stretching to a greater extent than when they did not receive curare, and the range of motion attained was no greater than when curare was not used. In fact, patients may tolerate less stretching with curare than without. For these reasons, use of curare appears to make no contribution in the treatment of this phase of spinal poliomyelitis.

Concomitant with this study, Richards, Elkins and Corbin[7] compared the effects of curare with those of hot packs as adjuvants to stretching for the relief of muscle shortening in 18 cases of acute poliomyelitis. They measured hamstring tightness by measuring straight leg raising in degrees with a goniometer. They could demonstrate no difference between curare and hot packs as aids to stretching in their study. In the 35 cases of these two studies, there is no objective evidence of superiority of either hot packs or curare

7. Richards, R. L.; Elkins, E. C., and Corbin, K. B.: Curare in the Treatment of Poliomyelitis, Proc. Staff Meet., Mayo Clin. 22:34, 1947.

as aids to obtaining normal muscle length in acute poliomyelitis. The inability even in a small series of cases to demonstrate that either is better than stretching alone raises the question from a practical point of view as to whether or not too much emphasis has been placed on them in the treatment of poliomyelitis. Might not careful and intelligent stretching be sufficient to prevent fixed deformities in these cases? The answer must come from studies on many more patients than were observed here.

This study was not set up to evaluate either hot packs or curare for relief of pain during the early acute stage, when muscle spasm may be severe. It is possible that at that time these adjuvants may be of value.

Conclusions

By objective tests, the effects of hot foments and intramuscular aqueous curare as adjuvants to muscle stretching were compared with the effects of stretching alone or stretching plus saline placebos in 17 cases of acute poliomyelitis. The criterion of effectiveness was the time necessary to achieve a standardized normal range of motion in the hamstring, back, and neck muscles. Patients with nonparalytic poliomyelitis regained normal motility more rapidly than those with paralytic involvement. Neither hot foments nor curare showed a clear-cut effect in aiding the return of normal motility. Curare did not increase the patient's tolerance to stretching. The question is raised whether or not the value of these adjuvants in treating poliomyelitis is commensurate with the effort necessary to apply them, often at the expense of therapeutic measures of real value.

The discussion of this article will be published in a later issue of the ARCHIVES.

CINERADIOGRAPHY

Its Technic and Application *

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This article comprises a short account of the cineradiographic work I have been doing since 1921. In such short compass it is impossible even to mention the various methods that have been tried in the past, in different countries, to bring this subject to a successful conclusion.

The method which I have adopted may be called the indirect method, in which the fluorescent screen image is photographed with a special cinematograph camera.

The intensity of the light emitted by the fluorescent screen is not particularly strong; it can be increased if the intensity of the beam of roentgen rays to which it is subject is also increased, but this, of necessity, means an added exposure risk to the subject under examination. In addition, to make the greatest possible use of all the light available, a lens of very large aperture is required, together with the photographic film of great sensitivity.

* Read at the Twenty-Fourth Annual Session of the American Congress of Physical Medicine, New York, Sept. 5, 1946.

At the same time, the film must be protected from the direct beam of roentgen rays which escapes beyond the fluorescent screen, a very small percentage of which — about 6 per cent — is absorbed by the screen.

From the outset, the risk to the subject of overexposure to radiation had to be considered together with the strain on the x-ray tube. A switch was therefore incorporated in the apparatus which synchronized the excitation of the x-ray tube with the opening of the camera shutter. In this way, the exposure of the patient to radiation was reduced by half, and the strain on the tube was reduced to a corresponding extent.

A great number of experiments were carried out during these early years, and it was not until 1933, when more brilliant screens, more sensitive photographic emulsion, and a lens of wider aperture was obtainable —(0.85) that adequate records could be produced of the movements of all the joints with the exception of the hips and pelvis, at speeds up to 12 frames a second (one twenty-fourth of a second exposure). Films of the heart and stomach were made at a slightly slower rate.

Since this time, improvements have been rapid. It has been found possible to reduce the intensity of the beam of rays considerably, and still obtain records of joint movements in one one-hundredth of a second. Films of the heart can easily be taken in a fiftieth of a second, which is sufficiently fast to produce a slow motion effect when projected on the screen.

As exposures have been reduced, the possible risk to the subject under examination has been steadily diminished until, at the present time, he receives possibly less radiation than he would in an ordinary complete roentgen ray examination.

After development, the 16 mm. film negative is printed and the positive is joined up into a continuous band. Films of this size are so easily handled in comparatively short lengths that all processing can be carried out rather simply. This band, containing complete cycles of movement, can be threaded through the projector and allowed to run continuously while the motion is studied. To date, I have taken nearly 1,500 cineradiographic films. It might be mentioned that, at the maximum, the patient does not receive more than about 64 γ of radiation for any single examination, and the proceeding is simple, reliable and safe.

Cineradiography not only opens up a vast field in research but gives invaluable aid in medical diagnosis. It is not yet possible to set a limit to its uses and applications, and, although a great deal of experimental work has been carried out, much more is required before its potentialities are adequately assessed. Its value in the examination of the normal movements of joints is obvious, just as is the detection of possible causes of restricted movements, and accurate comparison of the degree of movement before and after treatment is possible.

It is probable that in the future a cineradiographic record of the heartbeat will be included in the complete medical examination of that organ as a routine procedure, but before this technic can be fully utilized in the diagnosis of abnormal conditions further study of normal cineradiographic appearance is necessary.

Just as it is necessary to possess adequate knowledge of the normal appearance of an organ under examination in a "still" roentgenogram before proceeding to the diagnosis of the abnormal, so it will be necessary to be equally familiar with the appearance in normal and abnormal movement in a cineradiographic film. The response of the organs to the action of drugs offers another interesting field of study of cineradiography. It may be advisable to make films of the heart, recording simultaneously the electrocardio-

graph tracing at the base of the film. I have already done this successfully, both with the cathode ray oscilloscope and with the Cambridge string electrocardiograph. Needless to say, sound recording can always be incorporated.

Further examples of the uses to which cineradiography can be put in the medical sciences could be multiplied almost indefinitely. Nothing has so far been mentioned as to its application in medical education. Students assimilate knowledge far more easily if they can study the actual movements at leisure, and permanent records are always available.

In experimental physiology, cineradiography has already proved its worth, but in experimental science generally its value has yet to be assessed.

In February, 1936, by the generosity of Lord Nuffield, a cineradiograph apparatus was installed at the Nuffield Institute of Medical Research at Oxford. The department was opened by the late Sir Farquhar Buzzard, Bart., regius professor of medicine, and I gave a demonstration of the use of the apparatus. Subsequently, some experimental work with the apparatus was undertaken by Dr. A. E. Barclay in 1939; a paper was published in conjunction with Sir Joseph Barcroft, F.R.S.; Dr. Barron and Dr. K. J. Franklin on roentgenographic demonstration of the circulation through the heart in the adult and in the fetus and the identification of the ductus arteriousus.

Apart from general examination of patients for diagnostic purposes and the recording of normal movements of healthy patients, several important pieces of research work have been carried out. In the Hunterian Lecture of the Royal College of Surgeons in January, 1937, I demonstrated the results of research on the movements of the esophagus, stomach and duodenum during the passage of an opaque meal. Valuable information was obtained of the exact mechanism of peristalsis and the passage of the meal.

In 1939, this method of investigation was used to demonstrate the action of the Bragg-Paul pulsator. The films obtained were shown at a meeting of the Physiological Society of Great Britain. The pulsator was jointly designed by Sir William Bragg and Mr. Paul.

The normal respiratory movements of a healthy man and woman were shown, and the movements were observed when the depth of respiration was increased by the use of the pulsator. Such movements are similar to those observed in deep breathing of the subject, increased diaphramatic movement being evident as well as increase in the costal excursion. In the films of unassisted quiet breathing, the usual pause at the end of respiration can be seen and measured. This is not evident in the artificial respiration films, however, when a pause occurs between inspiration and expiration.

In conclusion, it may be stated that only by the cineradiograph method of examination can one adequately study the functions of organs and joints and obtain complete records of movements.

The original demonstration of actual cineradiograph films was given at the Royal Society of Medicine in London, on May 1, 1934, and some of the earlier results were demonstrated at the International Congress of Radiology held in Chicago in 1937.

A film has been made to demonstrate the value of artificial pneumothorax in cases of tuberculosis of the lungs, and has been incorporated in a film produced by the Gaumont British Educational Film Co. at the request of the British Council. This film has now been issued and is being shown in South America.

SOME FACTORS REGULATING THE COMPOSITION AND FORMATION OF HUMAN SWEAT *

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Introduction

Although sweat is a major secretion of the body, orderly knowledge of the factors controlling it is lacking in many particulars. This is not surprising in view of the complexities involved in its study. Not only is it produced over a wide area and therefore collected and measured with great difficulty, but its composition and amount[1] vary widely from one area of the body to another under the same thermal stimulus. Furthermore, it is well known that the specialized areas of the palms and soles sweat continuously,[2] whereas other areas sweat in response to heat or exercise. Even less information is available about fluctuation in its composition in the same area. Johnson and colleagues[3] reported from analyses of forearm sweat samples that the chloride concentration increases with an increase in three more or less independent factors: skin temperature, rectal temperature and rate of sweating. These same workers as well as previous investigators[4] noted the rather marked variation from person to person in the level of sweat chloride in the same area under the same conditions.

Great as are the difficulties of quantitative study in this field, it would seem important to explore further the function of this major organ, not only to understand better additional regulatory factors in human physiology but also to be able to allow more intelligently for the amounts of water, salts and organic compounds lost by this route, especially during hot weather and during the therapeutic application of heat or hyperthermia. Even in a temperate environment, the sweat cannot be wholly ignored in any detailed balance study. Another point of interest is the striking variation among individuals in sweat composition.[5] Does this offer us another tool for studying the constitutional factors of our patients?

This report is a preliminary one on only portions of the work to date and on only a few aspects of that portion. Samples of sweat were collected from various skin areas, but, since sizable samples were obtainable under temperate conditions only from the palms (and soles), the discussion will be limited to the palmar area. It is realized that the palms and soles are specialized areas and therefore perhaps ideally less suitable for the study of thermal stimuli than other areas, but, as will be shown, they respond simi-

* This research was aided by a grant to Columbia University from the Baruch Committee on Physical Medicine.

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* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 6, 1947.

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4. Dill, D. B.; Hall, F. G., and Edwards, H. T.: Changes in Composition of Sweat During Acclimatization to Heat, Am. J. Physiol. **123**:412, 1938.

5. Johnson, Pitts, and Consolazio.3 Dill, Hall, and Edwards.4

larly to other areas in respect to composition, if not to amount, of sweat. This report will also be limited to the discussion of chloride concentration; the other analytic results will require further work before they are ready for reporting.

Methods

The initial problem was to devise a simple means of obtaining and analyzing samples of sweat, methods usable on patients without application of strenuous exercise or heat. A report of Michelsen and Keys[10] mentions the use of a waterproof cover over an absorptive pad or bandage on a local area. Adaptations of this procedure proved practicable. Standard gauze squares were found to have a very small blank content of the substances to be analyzed; vinyl plastic sheeting sealed at the edges by waterproof adhesive tape served to cover the gauze during collection. The skin area was washed with distilled water before collection; the gauze pad was weighed in the same stoppered flask before and after collection, the difference being the weight of sweat. Sweat from approximately 6 square inches was collected in this way.

To obtain material for analysis, a measured amount of water was added to the gauze in the flask, the mixture shaken and suitable aliquots of the supernatant solution taken for the analyses desired. The necessary time of collection varied with the rate of sweating: one to two hours in most cases to obtain 0.1 to 0.2 Gm. The volume of the aliquot varied, of course, with the amount of sweat and the amount of water added. The equivalent of approximately 50 mg. of sweat was found sufficient for analysis of chloride, nonprotein nitrogen or urea. Half this amount was sufficient for estimation of lactate. For chloride, the aliquot was evaporated nearly to dryness before analysis by the Keys semimicro modification[6] of the method of Volhard. The small volume achieved by evaporating nearly to dryness resulted in a sharper end point. Nonprotein nitrogen was determined by the method of Daly,[7] lactate by the method of Edwards[8] and urea by urease method of Hawk and Andes.[9] Various checks were carried out on the suitability of these methods for the material at hand, both in regard to interfering substances and blanks of the added reagents and materials.

The experimental program reported here is conveniently divided into three parts: 1. First, a survey of the amount and chloride concentration of palmar sweat was made during the temperate fall months on 86 subjects, approximately equally divided between the sexes, including 27 normal persons and 59 patients with various diseases. 2. Next, repeated palmar sweat samples were obtained on a smaller group of normal subjects and a few selected patients to learn something about day to day variation in chloride concentration. 3. Finally, the effects of extremes of temperature were studied by collecting palmar sweat samples on 7 normal subjects exposed to three environmental conditions: (1) in a normal temperate room, (2) at 37 C., and 45 per cent relative humidity in an incubator room and (3) at 4 C. in a refrigerated room. Strenuous exerise was avoided under all three conditions. In addition to sweat samples, urine and blood samples were collected during each exposure, rectal temperature was taken before and after each exposure and accurate weight changes (within 7 Gm.) were measured as an index of total sweating.

6. Keys, A.: The Microdetermination of Chlorides in Biological Materials, J. Biol. Chem. 119: 389, 1937.
7. Daly, C. A.: The Determination of Non-Protein Nitrogen with Special Reference to the Koch-McMeekin Method, J. Lab. & Clin. Med. 18:1279, 1933.
8. Edwards, H. T.: A Simplified Estimation of Lactate in Normal Human Blood, J. Biol. Chem. 125:571, 1938.
9. Hawk, F. L., and Andes, J. E.: A Simplified Method for the Determination of Blood Urea, Am. J. Clin. Path. (tech. supp.) 2:153, 1938.

Results

1. On the basis of collection of single samples of palmar sweat on 86 persons and their analysis for chloride, it is apparent that there is extreme individual variability, even more than might be expected from previous reports.[1b-c-d] Table 1 presents a summary of these data broken down between the two sexes. Obviously, there is no real difference between the sexes as groups. These 86 subjects included 27 normal persons and 59 patients with various diseases. From these spot analyses no difference between the normal and the ill could be discovered, and no characteristic pattern of any one disease could be picked out. Rheumatoid arthritis (14 patients), Addison's disease (4 patients) and hypertensive cardiovascular disease (6 patients) were particularly looked into for distinctive features. However, the patients with Addison's disease were compensated with respect to salt and water, except in 1 instance in which there was only a moderate reduction in serum sodium. The patients with hypertensive disease were under separate investigation for the effects of varying salt intake, but no correlation was found between chloride content of palmar sweat and chloride intake or level of blood pressure.

In respect to rate of palmar sweating, 2 patients with hyperthyroidism tested showed relatively high values as might be expected, but not outside the normal range. Also, in line with the report of Kauf and Zak,[10] 7 patients with frank cardiac failure showed a somewhat low rate of palmar sweating but, again, well within the range of normal subjects.

The low mean chloride content of the palmar sweat (31 milliequivalents per liter), as well as the extremely low occasionally values (less than 10 milliequivalents per liter), are also worthy of note. This mean value is less than one-third that of normal serum, and the low values are less than one-tenth the serum value. It is apparent that under these conditions the sweat is far from transudate and the total chloride loss is minute. However, in view of the large amount of lactate found in palmar sweat, the loss of sodium may be considerably greater.

2. The second portion of the experiments aimed to answer the question whether these single values for each individual are characteristic of the individual or whether there is as much day to day fluctuation in one individual

TABLE 1. — *Variations in Palmar Sweat from Individual to Individual.*

	Male	Female	Total
Number of subjects	41	45	86
Palmar sweat rate: (Gm./6 sq. in./hr.)			
Mean	0.084	0.078	0.081
Range	0.010-0.220	0.030-0.235	0.010-0.235
Standard deviation	0.053	0.041	0.048
Palmar sweat chloride concentration (mEq./liter.)			
Mean	32.8	29.0	31.0
Range	4-100	8-69	4-100
Standard deviation	18.6	18.4	18.6

as there is from person to person. Fourteen of the normal subjects were tested repeatedly during the temperate fall months and their values found to be quite constant. Four of these had analyses repeatedly over a two to three month period, and two of these serial analyses are shown on chart 1. It is apparent that the fluctuations are minor in relation to the differences between persons and in some cases could be attributed to analytic limitations.

10. Kauf, E., and Zak, E.: Störungen des Wasserhaushaltes insbesonders der Schweisssekretion bei Kreislaufkranken, Wien. klin. Wchnschr. 40:1405, 1927.

Rather large fluctuations in sodium chloride intake did not affect this relative constancy; subject E. S. was given 6.0 Gm. of sodium chloride daily in addition to the salt in the diet for two days, with no change detectable. It seems probable from the work of Conn and his colleagues[11] that salt restriction would lower the sweat chloride level, at least under conditions of heavy sweating. Thus, within wide limits the general level of sweat chloride is a char-

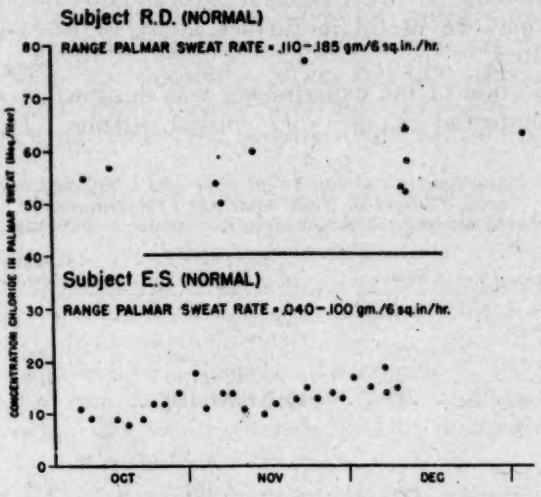

Chart 1. — Variations over a two and a half month period in chloride concentration in palmar sweat of two normal persons.

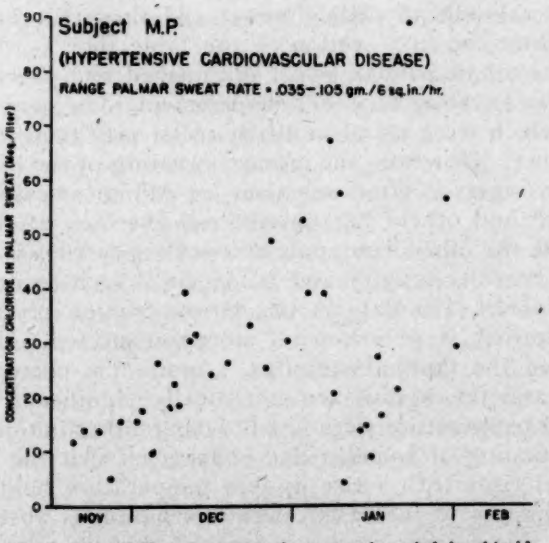

Chart 2. — Variations over a three month period in chloride concentration in palmar sweat of a patient with hypertensive cardiovascular disease.

acteristic of the normal person, a sort of physiologic fingerprint. This fits with the observation[4] in experiments of thermal sweating that individuals have a characteristic range of sweat chloride and that those with high values are more prone to heat cramps.

11. Conn, J. W.; Johnston, M. W., and Louis, L. H.: Acclimatization to Humid Heat: A Function of Adrenal Cortical Activity, J. Clin. Investigation 25:912, 1946.

However, 4 patients with hypertensive cardiovascular disease who also had repeated estimates of palmar chloride showed less constancy in the level of chloride. The values for one of them are presented in chart 2. The extreme fluctuations in this patient could not be correlated with any observed clinical fluctuations, with diet or with medication. The other 3 patients showed similar but somewhat less striking fluctuations. At the present time further discussion of this observation would not be warranted. It merely serves to point out that the sweat chloride level is not constant in all persons and the method may be useful in further study of disease processes and constitutional factors.

3. The third portion of the experiments was designed to study the effect of extreme environmental changes in 7 normal persons. Table 2 presents a

TABLE 2. — *Variations in Palmar Sweat Rate and Chloride Concentration with Changes in Environmental Temperature.*

	Mean	Range	Relative Values, %	Standard Error of Mean Relative Values, %
Palmar sweat rate: (Gm./6 sq. in./hr.)				
Hot	0.078	0.065-0.108	69	± 9.6
Temperate	0.121	0.082-0.180	100	.....
Cold	0.225	0.103-0.300	191	±24.7
Palmar sweat chloride concentration: (mEq./liter.)				
Hot	88	56-167	181	±21.8
Temperate	52	30-100	100	.....
Cold	38	22-58	79	± 7.6

summary of the amounts of palmar sweat and their chloride concentration. It is apparent from the first section of the table that as thermal sweating occurred the amount of palmar sweat diminished and there was a marked increase in palmar sweating in a cold environment. On superficial inspection, these findings, which were noted in all subjects, may tend to run counter to common experience. However, the intense sweating of the backs of the hands and between the fingers is often mistaken for palmar sweating, and previous work of Ikeuchi[12] and others has pointed out the lack of thermal sweating of the palms. On the other hand, palmar sweating is known to be stimulated by sympathetic nervous activity and mild pain,[12] such as occurred with our subjects in the cold. The data in the second section of the table, on the chloride concentration, were somewhat more unexpected. Here the chloride content paralleled the thermal stimulus. Again, the changes were present in all subjects, and the figures are statistically significant. No significant changes in rectal temperature were found during either hot or cold exposures. Apparently the finding of Johnson and colleagues[3] that the chloride content of thermal sweat rises with a rise in skin temperature holds for the palms, although the stimulus to increased sweat formation is absent in that area. Apparently also this mechanism for control of chloride concentration carries on in the cold range where thermal sweating is absent. The mechanism for this control is not clear. There was a slight increase in plasma chloride following the hot exposure, from a mean of 105 milliequivalents per liter to 108, which on statistical test is of probable significance, and a similar drop, to 102 milliequivalents per liter, in the cold. As might be expected, the urinary chloride fell significantly during active sweating in the heat but did not change significantly in the cold. With present information it is not possible

12 Kuno, Y.: The Physiology of Human Perspiration, London, J. and A. Churchill, 1934.

to demonstrate any causal relationship between these blood and urine changes and those in the sweat.

Comment

The slight insight which these findings gives into some of the characteristics of palmar sweat and its regulation falls far short of answering the questions proposed in the introduction. Only one of probably many factors controlling sweat chloride concentration can be envisaged. Any general formula for predicting chloride and water loss in sweat under various environmental conditions is far from solution. It may be said, however that sweat is in the main a remarkably dilute chloride solution and that, therefore, practical replacement of salt and water during sweating may often furnish much more salt than necessary, particularly if isotonic saline solution is the replacement medium.

Many more questions are raised than are answered. For example, in the presence of very low chloride, are there other negative ions to replace it or is the sweat very hypotonic? It is hoped that sodium and potassium analyses may help answer this question. The high lactate content, even at rest, reported by others,[13] which was also found in this study, suggests that the total ionic strength is relatively high.

The possible similarity between the sweat glands and the renal tubules is obvious. There is very little data to support the similarity of control. The relative insensitivity of the sweat chloride level to changes in chloride intake reported here is a case in point.

Summary and Conclusions

1. Technics were adapted for the collection of uncontaminated samples of sweat from the palms and other areas.
2. Analytic methods were adapted for the analysis of chloride in these small samples.
3. Under temperate conditions the level of chloride in palmar sweat as measured on 86 subjects varied widely from individual to individual, ranging from one-twentieth to nine-tenths the serum levels and was less than half the serum level in over two-thirds of the subjects.
4. The range of chloride concentration was the same in 27 normal persons as in 59 patients with various diseases.
5. In normal persons under temperate conditions the levels of chloride in the palmar sweat remained fairly constant from day to day.
6. In 4 patients with uncomplicated hypertensive cardiovascular disease the level fluctuated more widely.
7. On the basis of 7 normal subjects exposed to three environmental temperatures, it was concluded that (*a*) palmar sweating decreased in the heat and increased in the cold and (*b*) the chloride concentration of this sweat increased in the heat and decreased in the cold.

13. (*a*) Fishberg, E. H., and Bierman, W.: Excretion of Lactic Acid in Sweat, Proc. Soc. Exp. Biol. & Med. 29:102, 1932. (*b*) Dill, D. B.: Life, Heat and Altitude, Cambridge, Mass., Harvard University Press, 1938. (*c*) Radsma, W., and Nizar: On the Excretion of Lactic Acid by the Skin, Acta brev. Neerland 8:147, 1938.

The discussion of this paper will be published in a later issue of the ARCHIVES.

SERRATUS MAGNUS PARALYSIS *

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The serratus magnus muscle receives its nerve supply from the long thoracic nerve, and paralysis of this nerve will produce a protruding scapula and inability to abduct the arm completely.

The medical literature reveals a recognition of this condition by Velpeau in 1825, but little was added to the knowledge of the etiology, pathology and treatment until the last decade. In 1938, Horwitz and Tocantius analyzed the anatomy of the long thoracic nerve and the kinesiology of the serratus magnus muscle. They also emphasized the importance of derotating the scapula by immobilizing the elbow in flexion, thereby releasing the pull of the biceps and coracobrachialis muscles on the glenoid end of the scapula. Wolf, in 1941, demonstrated a brace which pressed the scapula to the thoracic wall preventing rotation of scapula while allowing free use of the arm. During the war Ilfeld and Holder reported the case of soldier, in whom serratus magnus paralysis developed after stretching of the long thoracic nerve when he was hoisting a fully loaded knapsack to his shoulders and carrying it on a hike.

The orthopedic surgeons have been interested chiefly in surgical procedures that might anchor the scapula to the ribs or to the posterior spinal process. Muscle transplants have also been attempted, such as the Haas operation where teres major is substituted for the serratus magnus. The surgical treatment of serratus magnus paralysis is unsatisfactory, according to Overpeck, Darvello and Ghormley.

Anatomy

The nervous system does not influence muscle differentiation; but the nerves, owing to their early attachment to the muscle rudiments, indicate in a general way the position of origin of many muscles. Likewise, it is found in many instances that the nerves indicate the path of migration of the muscles. The serratus magnus is an excellent example of the migrating muscle, whose nerve supply indicates its origin in the cervical region. The long thoracic nerve — the external respirator nerve of Bell — is one of the posterior thoracic nerves which supplies the serratus magnus muscle. It usually arises by three roots, the fifth, sixth and seventh cervical nerves. The upper two roots traverse the substance of scalenus medius muscle, and the root from the seventh nerve passes downward behind the brachial plexus and the proximal part of the axillary artery and vein along the axillary surface of the serratus magnus muscle and superficially on the lateral thoracic cage. In some animals the serratus magnus and the levator scapulae constitute a single sheet of muscle, passing from the transverse processes of the cervical vertebrae and the upper ten ribs to the vertebral border of the scapula. Progressive loss of the intermediate portion divides the sheet and leads to its separation into a definite levator scapulae and serratus magnus muscle. The serratus magnus, once defined, exhibits changes similar to the trapezius muscle. There is a trend toward concentration of the muscle insertion at the superior, medial and inferior angles of the scapula, thereby establishing upper and lower functional component.

* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 3, 1947.

In quadruped animals the serratus magnus muscle transmits the weight of the upper body to the scapula and takes an active part in locomotion. It is an extensive muscle, which in the biped position helps to stabilize the scapula. Only three ribs send digitations to the superior angle of the scapula, whereas five ribs send digitations to the inferior angle. The upper digitations draw the scapula forward, thereby increasing the reach of the outstretched hand. The lower digitations steady or pull forward the inferior angle when the arm is raised in front of body.

The function of the serratus magnus may be divided into three categories: 1. As a stablizing force, it fixes the scapula when the pectoralis minor muscle is actively used in deep breathing and when the triceps delivers a blow with the fist. 2. As a balancing force, it counteracts the trapezius, rhomboids and levator scapulae muscles. The serratus magnus also reacts against the rotating force on the scapula produced by the weight of the arm, transmitted through the long head of the biceps, and also the contraction of the biceps. 3. As an active force, it brings the scapula forward thereby increasing the reach of the hand, and it raises the chest when the scapula is stabilized.

From this discussion it is evident that a paralyzed serratus muscle will produce two deformities: protrusion of the scapula from the thoracic wall — i. e., a winged shoulder — and rotation of the scapula due to the weight of the arm. The principle of treating muscle paralysis has always been immobilization in a resting position to prevent stretching of the muscle. When this principle is applied to paralysis of the serratus magnus, it means that the scapula must be held close to the thorax and the scapula also must be derotated. Elevation of the arm must also be prevented.

Etiology

In reviewing the 28 cases on which this discussion is based, it is noted that nearly 50 per cent of the patients give the history of first experiencing weakness on lifting the arm or observing protrusion of the scapula. In some of these cases slight neuritic pain was present, but it was neither severe nor prolonged. The patients had been exposed to cold or a draught. Some of them related their symptoms directly to air-conditioned rooms or trains. The onset in this group was definitely related to refrigeration, recalling the causation of Bell's palsy. In fact, one patient had a combined paralysis of the facial and the long thoracic nerve. The possibility of an avitaminosis was not determined.

Five patients gave a definite history of trauma. In one of the cases, that of a soldier referred from Halloran General Hospital, the paralysis was apparently due to carrying a pack. Manual work, such as lifting, was responsible in 2 cases, and squash and football injuries preceded the symptoms in two cases. The injury was apparently to the nerve and not the muscle. Wolf stated that a likely site for localizing injury to the long thoracic nerve is between the coracoid process and the second rib, where the nerve becomes angulated. A downward thrust of the shoulder girdle or a lateral twist of the head may increase the angulation of the nerve and overstretch the nerve fibers. He also emphasized the fact the neighboring bursae, such as the subcoracoid and the subscapular, may involve the nerve.

Direct injury to the nerve or pressure on the nerve was seen in 2 cases of excision of carbuncles and 1 of a radical operation for mixed tumor of the parotid. Another patient with a similar injury is under treatment, but the case is not included in this series. The injection of tetanus antitoxin was apparently responsible in 3 cases in this group; a fourth patient, whose case

is not included here is still under treatment. The history is usually that of a severe reaction with urticaria on the fifth day, and a day or two later paralysis sets in. The deltoid and serratus magnus seem to be the muscles usually involved.

In two patients the paralysis developed post partum. Whether it was due to trauma during a difficult delivery when the patient was pulling on straps attached to the foot of the bed or to exposure during or after delivery was impossible to determine.

Residual paralysis in poliomyelitis may involve any voluntary muscle in body, and there is no reason why the serratus magnus should be exempt. However, in reviewing several hundred cases of poliomyelitis only 2 were found which were included in this study; a third patient is still under treatment. The 2 patients with poliomyelitis recovered completely from the serratus magnus paralysis while in bed under going treatment for extensive paralysis of other muscle groups.

Treatment

The treatment followed in these cases is the same as that for paralyzed or temporarily paralyzed muscles anywhere else in the body. It involves three principles: immobilization, stimulation and exercise.

1. *Immobilization.* — It is generally recognized that a weakened muscle that is kept on a stretch has a poor chance to recover. The problem is therefore to immobilize the muscle in such a position as to approximate the origin and the insertion. The serratus magnus muscle is stretched when the scapula is displaced from the thoracic wall and when the scapula is rotated upward and laterally. Any brace or support for the serratus magnus muscle should therefore be so constructed as to press the scapula to the thoracic wall and also derotate it downward and medially. The brace used presses the scapula against the thorax by means of a metal spring of semicircular shape; it goes over the shoulder, and its ends exert pressure on the scapula in the back and on the chest anteriorly. The leather brace has a sleeve that goes down on the arm preventing elevation of the arm. By means of a strap across the chest and back below the opposite shoulder, the scapula is derotated downward and medially. Sometimes this may be supplemented by a sling for the forearm, releasing the weight of the arm and the pull through the biceps and coracobrachialis muscles. This brace is made of leather from a mold of the patient's shoulder. It is worn day and night until protrusion and rotation is corrected. This time varies from three months to a year.

2. *Stimulation.* — While the serratus magnus muscle is immobilized to prevent overstretching, an attempt is made to stimulate this muscle by heat and electrical contractions. The muscle can be found between the pectoralis major and latissimus dorsi muscles, above the origin of the external oblique muscle. Interrupted galvanic stimulation is first used; faradic stimulation is used as soon as the muscle responds to this current.

3. *Exercises.* — The exercises used are of two types. The first consists of voluntary attempts to contract the serratus magnus. This is done by a forward thrust of the shoulder girdle. It is typified by the motion of a carpenter when he uses a plane. The patient sits at the side of a table with the arm resting on the surface of the table and slides the arm forward. Any form of push-up can be performed against a wall or against a table with the body at a 60 degree angle to the table. It can also be done in the prone position on a floor or on the hands and knees by pushing the body weight away from the floor. The other type of exercise is concerned with the supporting muscles of the scapula — the trapezius, especially the lower part, and the rhomboids.

These exercises are repeated at each visit of the patient and are also performed by him three times a day at home.

Report of Cases

CASE 1. — A woman, aged 23, was first seen on Feb. 16, 1938. On the previous New Year's Eve she had attended a party and had been exposed to severe weather. The following morning she could not raise the right arm completely. On admission she had a typical right serratus magnus paralysis. Electrical stimulation and exercises were started immediately, and a brace was applied on March 7. She received a total of thirty-seven treatments; these were discontinued on June 15, but she continued to wear a brace at night and performed exercises twice a day at home. On Dec. 14, 1938, she was able to support weight on the right hand. She was discharged Jan. 1, 1939, with recovery perfectly satisfactory.

CASE 2. — After a trip on an air-conditioned train on Aug. 15, 1939, a 26 year old man experienced weakness of the left side of the face and left shoulder. When first seen, on December 7, there was only slight weakness of the left side of the face, but the left scapula was winged and all motions of the left shoulder were limited in extent

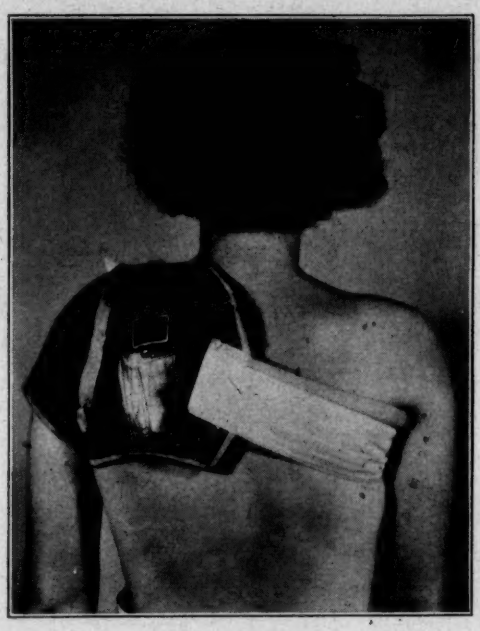


Fig. 1 — Brace used in serratus magnus paralysis.

and strength. A diagnosis of paralysis of the left facial nerve and left long thoracic nerve was made. Electrical stimulation and exercises were begun, and a shoulder brace was applied on Jan. 18, 1940. The face was normal. Examination on March 28, revealed normal motion in the shoulder, except for flexion and elevation. On July 10, the patient was still unable to support his body weight on his left hand. He was advised to do more strenuous gymnasium work and to swim twice a week. On March 6, 1941, all muscles about the left shoulder had regained normal strength, and the patient was discharged with a perfectly satisfactory result.

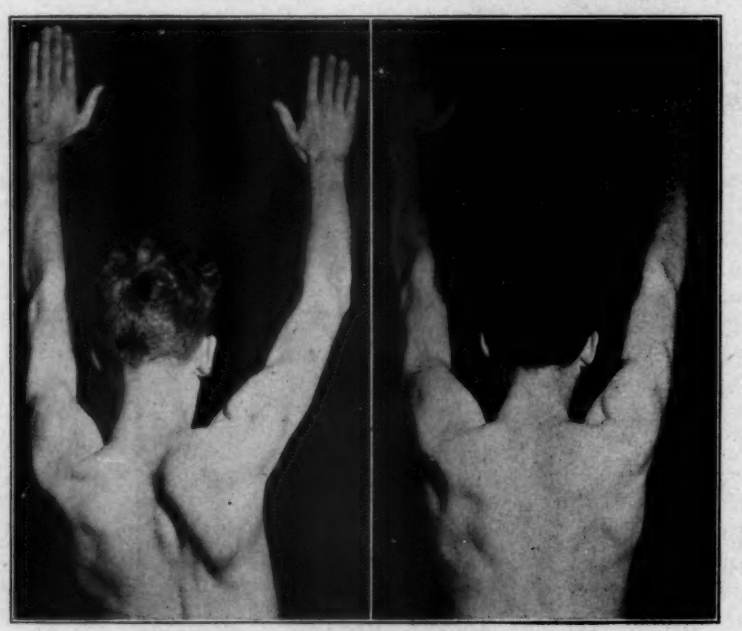
CASE 3. — A 22 year old swimming instructor noticed a winged shoulder and inability to raise her left arm completely six weeks previous to her admission to the hospital. She was first seen on July 1, 1938. She had the typical signs and symptoms of left serratus magnus paralysis. She was given a brace (fig. 1) and instructed in home exercises. On October 5, 1938, she was able to support her weight on her left hand and was discharged. The serratus magnus paralysis was probably due to a continuation of exposure and trauma or overexercise.

CASE 4. — An infantry private, aged 25, was referred on April 12, 1941, with a paralysis of the right serratus magnus muscle, suffered in training, probably as a result of carrying a heavy pack. He was treated with a brace and exercises and continued

to do light duty. The medical officer in charge of his camp reported on Oct. 21, 1941, that the patient had recovered completely and was doing full duty.

CASE 5. — A woman, aged 50, had a carbuncle on the right posterior portion of the neck incised on Nov. 15, 1937. She complained of weakness of the right shoulder, inability to raise the right arm and protrusion of the right shoulder blade. She was first examined on March 4, 1938, and presented a typical serratus magnus paralysis probably traumatic in origin. The long thoracic nerve was apparently caught in scar tissue, for the attending surgeon reported that the nerve had not been injured at the time of operation. The patient was given applications of continuous galvanic current. to soften up the scar tissue and a brace for the shoulder. On June 23, wearing of the brace was discontinued, but exercises were continued. By Jan. 12, 1939, the patient had good control of the right shoulder, and there was no protrusion of the scapula. She was then discharged.

CASE 6. — A 22 year old man was stricken with poliomyelitis on July 13, 1942, and was admitted to the Hospital for Special Surgery on August 19. He showed extensive residual paralysis on the date of admission. On September 4, paralysis of the right serratus magnus muscle was discovered (fig. 2*A*). He was treated with hot fomentation,



A B

Fig. 2. — Serratus magnus paralysis before (*A*) and after (*B*) treatments.

bed rest and muscle reeducation. On discharge, Dec. 31, 1942, he had recovered from the poliomyelitis, the right serratus muscle was normal and the right arm was able to support the body weight (fig. 2*B*).

Results

Of the twenty-eight patients, 18 were male and 10 were female. The youngest was 12 years old; the oldest, 62. The average age was 32 years.

The earliest case to come under observation was seen one week after the onset of symptoms; most of the patients had had symptoms for several months. One patient was seen after the paralysis had been present for six months. Because of the variation in time from the onset of symptoms to the institution of adequate treatment, the time of recovery varied. The shortest recovery period was two months and the longest one twenty-two months, with an average of seven months. Exposure was the etiologic factor in 13 cases (47 per cent); trauma, in 7 (25 per cent); poliomyelitis, in 2 (7 per cent), and tetanus antitoxin in 3 (10.5 per cent). In 3 cases (10.5 per cent) the paralysis followed an operation. It is evident that the etiologic

factor plays a part in the duration of treatment. The idiopathic type and the postpoliomyelitic type responded better than the surgical cases. Early and proper immobilization of the scapula is probably the most effective part of the treatment.

Summary

The follow-up of 28 patients with paralysis of the serratus magnus muscle and the observation of 3 additional patients still under the treatment justifies the following conclusions:

1. In most cases the condition is idiopathic; there is usually a history of exposure with a possible avitaminosis. Trauma, including postoperative and postpartum, is responsible for a considerable number of cases. Serratus magnus paralysis may also follow tetanus antitoxin injections and poliomyelitis.

2. The deformity produced by serratus magnus paralysis is protrusion of the medial end of the scapula and a rotation of the scapula upward and laterally. Immobilization should therefore be accomplished by a support that presses the scapula to the thoracic wall and also derotates the scapula. Additional treatment is electrical stimulation and specific exercises.

3. With use of this kind of immobilization and treatment, 28 patients were relieved of their symptoms.

SPACE AND PERSONNEL REQUIREMENTS NECESSARY TO ESTABLISH A PHYSICAL MEDICINE AND REHABILITATION SERVICE IN HOSPITALS *

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As physical medicine attains the stature of a major service in hospitals of this country, it becomes more and more necessary to establish definite criteria as to working space, equipment and personnel needs in order to carry out the diagnostic and treatment aims of such a service.

Other major services have long provided established criteria as to their needs for space and personnel. Surgical services, for instance, have well defined criteria for the size and number of operating rooms in various types and sizes of hospitals. This is also true of the x-ray and the laboratory services.

In the course of inspection trips throughout the country, including Army, Veterans Administration and civilian hospitals, it has seemed many times as though the physical therapy department had been allotted a small amount of surplus space which could not be utilized by any other service, with no regard for the grave need of proper ventilation and lighting and other requirements for the establishment of a top-flight physical therapy department. Many an occupational therapy department has been established as an after-thought in

* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 5, 1947.

the damp and darkened shadows of the basements in the hospitals of this country. One instance comes to mind: In an otherwise well organized hospital, the occupational therapy department had been established in the basement next to the morgue!

Some occupational therapy and physical therapy departments have been allowed the luxury of being established in English basements and therefore are suspended half in the ground and half above the ground, with a few feeble rays of sunshine trickling through neglected basement windows.

Nowhere have I been able to find from authoritative sources an established guide as to the size or personnel requirements for physical therapy and occupational therapy departments in neuropsychiatric hospitals, tuberculosis hospitals or even in our General Hospitals. Facts and figures are as dry as dust, but if this specialty is to take its proper place in the medical profession throughout the country it is necessary that we consider and establish basic requirements in order that we may work in comfort and, even more important, with the greatest efficiency in all of our departments.

Perhaps the proper repository for such information should be the Council on Physical Medicine of the American Medical Association or, perhaps, the American Congress of Physical Medicine.

It is my suggestion that a file be set up in the proper place and that space, personnel and equipment requirements for all types and kinds of hospitals be kept on record and available to physiatrists throughout the country, as well as to the world. Physical medicine and rehabilitation is expanding not alone in this country, but in many countries of Europe and Asia. Because of the past war, new clinics and new hospitals are being built throughout the world, and I have had many requests within the past six months from China, India, Australia and France — to name a few of the sources — requesting information in order to set up a proper department of physical medicine and rehabilitation.

We have had some experience in the Veterans Administration during this past two years, because we are operating 123 hospitals at the present time, ranging in size from 50 to over 3,000 beds, and frequently the physical medicine departments of these hospitals have been held back and squeezed into the smallest amount of space possible. It has been necessary to draw on our experience in expanding these departments in the planning of the 75 new hospitals which we are building now and will build in the next few years. I wish to present the results of our experience.

The Physical Medicine and Rehabilitation Service of Veterans Administration hospitals has the following divisions: physical therapy, occupational therapy, corrective therapy, educational therapy and manual arts therapy.

In the general medical and surgical hospital of less than 500 beds, we have found that the patient turn-over is fairly rapid. It has been found necessary to have a good physical medicine department with complete physical and occupational therapy departments. In the majority of cases there is little need for educational or manual arts therapy in this type of hospital. In the Veterans Administration the long term chronic patient found in this type of hospital can be transferred to a larger hospital that has an active rehabilitation department. For civilian hospitals this would not provide an answer, and it has been my thought for some time that it is necessary to have a convalescent section in a civilian hospital to care for these long term chronic patients, to teach them to care for themselves and to walk again. Otherwise, we are not fulfilling our duties as doctors of physical medicine and rehabilitation.

In the new Veterans Administration general hospitals that are being built, the physical medicine and rehabilitation service has been allotted 8.75 square feet per patient. A large number of these new hospitals are of 1,000 bed capacity, and the space for physical medicine and rehabilitation is divided as follows:

600 square feet for the physiatrist for private office, examining and treatment rooms
3,310 square feet for the physical therapy department
780 square feet for corrective therapy, including a remedial gymnasium
2,140 square feet for occupational and manual arts therapy
970 square feet for educational therapy

This division accounts for 7,750 square feet, leaving approximately 2,000 square feet for toilet facilities, dressing rooms and showers for patients and the physical medicine staff.

To repeat: In the small, fast patient turn-over general hospital of from 200 to 500 beds, it is necessary to have good physical therapy and occupational therapy departments.

The space criterion for tuberculosis hospitals has been developed at 17 square feet per patient for physical medicine and rehabilitation. The Veterans Administration has 17 tuberculosis hospitals and 24 tuberculosis units in general and neuropsychiatric hospitals, with a total of approximately 10,000 patients at the present time. We have plans for six new tuberculosis hospitals. The majority of these and existing tuberculosis hospitals are of 500 beds or less, and in a typical 500 bed tuberculosis hospital approximately 8,500 square feet has been allotted for physical medicine and rehabilitation. This is divided as follows:

450 square feet for the physiatrist
2,000 square feet for the physical therapy department
4,200 square feet for occupational and manual arts therapy
700 square feet for educational therapy

It has been interesting to note the development of a rehabilitation center in one of our larger tuberculosis hospitals during the past year. The latest data available show that the operating cost of such a rehabilitation unit, or section, is approximately half that of an acute tuberculosis hospital. The acute section of the hospital was costing approximately $14.00 a day per patient and the rehabilitation unit approximately $6.00 a day per patient.

Neuropsychiatric hospitals have the largest amount of space per patient of any of our hospitals. We have developed a criterion of 30 square feet per patient for physical medicine and rehabilitation. In a typical 1,000 bed neuropsychiatric hospital this totals 30,000 square feet, which is divided as follows:

1,310 square feet for the physiatrist
8,424 square feet for physical therapy
1,435 square feet for corrective therapy
14,000 square feet for occupational and manual arts therapy
1,200 square feet for educational therapy

This leaves approximately 3,500 square feet for toilet facilities, showers and dressing rooms for patients and physical medicine staff. This total of 30 square feet is a tremendous amount of space to be devoted to physical medicine and rehabilitation in a neuropsychiatric hospital, but it has been gratifying during the past two years to see the psychiatrists turn to physical

medicine and rehabilitation for help in their treatment of psychiatric patients. Dr. C. C. Burlingame, of The Institute of Living, in a recent article in Journal of the American Medical Association said: "Other therapies are important adjuncts, but psychotherapy, in the form of personal tutoring, and sound physical medicine are a reliable basis for all present day psychiatric treatment aimed at restoring psychiatric patients to society."[1]

It has been astonishing to some of us who have been watching the development of physical medicine and rehabilitation in the treatment of the psychiatric patient to see the very real help that can be provided, not alone in the care of the psychoneurotic patient, but also in the long term psychotic patient. I feel that we have barely touched the surface in the help we can offer the psychiatrist in the care of his patients. It is necessary that we develop more research work and a broader view as to the expanding abilities of the physical medicine and rehabilitation service in order that we may offer the optimum of assistance.

More and more of the other major services of the Veterans Administration are depending upon the physical medicine and rehabilitation service for help in the diagnosis, treatment and rehabilitation of their patients. A recent survey of patient participation in the physical medicine and rehabilitation service of five general hospitals in one of our branches has produced some astonishing figures. These hospitals range from 350 to 500 bed capacity. It was found that 25 per cent of the patient load required physical therapy; 20 per cent of the patients received occupational therapy; 35 per cent, corrective therapy; 6 per cent, educational therapy, and 10 per cent, arts therapy. The survey demonstrates the need for an extensive department of physical medicine, including physical therapy and occupational therapy, in our smaller general hospitals, with less emphasis on our educational and shop programs.

Two years ago there were less than 1,000 persons employed in the physical medicine and rehabilitation service. As of June 9, 1947, there were 3,445 persons in this service with the Veterans Administration. We have increased the number of physiatrists from 25 full time doctors to 81. The number of physical therapists has increased from a few over 200 to 943, of which 531 are qualified. Occupational therapists have increased from 250 to 835 and 432 of them are fully qualified. The improvement in the caliber of the professional personnel has been reflected in greatly improved service to the patients. We have procured 366 corrective therapists, selected from some 20,000 physical educators who were engaged in physical reconditioning in the Army and Navy. We have, at the present time, 281 persons in educational therapy and 407 in manual arts therapy. We have arrived at the following ratios for occupational therapists and physical therapists: in general hospitals, one occupational therapist for 100 patients and one physical therapist for 75 patients; in neuropsychiatric hospitals, one occupational therapist for 100 patients and one physical therapist for 100 patients; in tuberculosis hospitals, one occupational therapist for 50 patients and one physical therapist for 75 patients.

The expansion of the physical medicine and rehabilitation service for the Veterans Administration has been expensive both for salaries and equipment and for the amount of space necessary for this service, but we believe it has been worth while and not alone in humanitarian terms. The following example shows that it pays in dollars and cents. In one of our general hospitals with a large chronic neurologic ward, particular emphasis on rehabilitation was placed by the neurologist and the physiatrist. The ward was filled

1. Burlingame, C. C.: Psychiatric Sense and Nonsense, J. A. M. A. 133:971, 1947.

with 120 World War I long term chronic neurologic patients. Many of these had been in bed for ten years. At the end of nine months, 55 of these patients had been discharged from the hospital and were able to care for themselves, feed themselves and dress themselves and were able to do either full or part-time work. Thirty more were up and about and able to care for themselves; 25 more had progressed satisfactorily in their rehabilitation, and only 10 were considered hopeless from the standpoint of rehabilitation. Counting $10.00 a day as the patient cost and the fact that these World War I veterans had a life expectancy of at least six years, it can be seen that the discharge of these 55 World War I patients will save the Government over a million dollars.

Dr. Paul H. Hawley, Chief Medical Director of the Veterans Administration, recently completed a long field trip throughout the country, including the Middle West, Southwest and West, and visited many Veterans Administration hospitals. At the completion of his trip he had the following to say about the Physical Medicine and Rehabilitation Service: "There is only one thing wrong with this service — there is not enough of it in any hospital which I visited."

In summary, I am asking again that a criterion be established for space and personnel requirements for our physical medicine service. I believe that this is most necessary in order that new hospitals being built in civilian communities may obtain the requirements in order to establish a complete physical medicine and rehabilitation service. We have made rapid strides during the past five years. If we are to continue our growth and to consolidate our gains, it is necessary that the basic requirements of the service be kept in mind. For too long physical medicine, physical therapy and occupational therapy have been kept in the small darkened corners of the hospitals of the land. In order to accomplish the aims and the ideals established for this service, it is necessary that we have ample room and sufficient qualified personnel in our hospitals to carry out the successful attainment of our goal.

Discussion of Papers of Drs. Donald A. Covalt and A. B. C. Knudson *

Dr. Charles O. Molander (Chicago): The Veterans Administration has done much to bring civilian hospitals to a better understanding of the term "rehabilitation," its objective and the means of attaining that objective. In order to help patients to leave the hospital sooner and in such condition that relapses are few and far between, (1) The "whole man" must be treated, not merely his disability; (2) Rehabilitation procedures must be commenced early; (3) The program must be progressive; and (4) All phases of the patient's schedule must be integrated so as to be purposeful.

The Physical Medicine service is pioneering in many phases which so far are only theories or fond hopes in most civilian hospitals:

1. The Medical Rehabilitation Board, which coordinates all methods of treatment directed toward the patient's ultimate recovery. Thus, all services of the hospital cooperate to direct treatment toward the individual as a whole, toward his mental and emotional reactions, as well as his physical ailments. This type of Board should be established in many civilian hospitals.

2. The VA educates general practitioners, specialists and lay groups to the value of physical medicine by the use of "live" demonstrations and scientific exhibits. Civilian departments of physical medicine should be equally alive to this phase, because too many physicians fail to take advantage of physical medicine in cases where it is indicated. Last winter my department put on a "live" television broadcast, a demonstration of physical medicine routine used for a shoulder sprain. We received many favorable comments and a request to put on another demonstration in the near future.

3. Teaching by means of lectures, manuals and films. Most civilian hospitals use the lecture method, but writing manuals and taking films require much time and money. I hope that these manuals and films will become available to civilian hospitals.

4. Effective research is best accomplished where hospitals and medical schools work together. The proposed re-

* Dr. Knudson's paper "Dynamic Aspects of Physical Medicine in the Veterans Administration," was published in the January, 1948 issue of the ARCHIVES.

search plan of the VA will be a welcome addition to the growing research program in physical medicine.

There are, of course, several phases which are impossible in civilian hospitals, at least for the time being. One is vocational guidance and the other vocational training. However, most hospitals with departments of physical medicine can prepare the patient for vocational training in a rehabilitation center. Community rehabilitation centers should be established in every large city. The New York Institute for the Crippled and Disabled has proven what such a center can do. However, the task is difficult and much missionary work must be done to educate physicians and laymen to the advantages of a center.

Such a dynamic program as carried on by the Veterans Administration will not permit physical medicine to "fall asleep" as it did after the First World War; but we in physical medicine must be on the alert. We must do our share in spreading the gospel of dynamic physical medicine! I would like to ask Dr. Knudson how many of the civilian hospitals have become interested in your program by inquiry of actual visitation?

Dr. Knudson (closing): I believe that numerous hospitals and clinics have become interested in Physical Medicine and Medical Rehabilitation as operated in the Veterans Administration. I have no actual figures in relation to this interest, but know that Dr. Covalt's office has received hundreds of inquiries concerning this phase of VA medicine from hospitals, clinics, medical schools and physicians in this country, Canada, Mexico and many foreign countries. Everyday, interested individuals or medical groups visit various VA installations to observe the functioning of the Physical Medicine and Medical Rehabilitation Service at the operating level. Medical and rehabilitation workers have visited Dr. Covalt personally from all parts of the United States and from several foreign countries, including Canada, Mexico, Portugal, England, Australia, China, Czechoslovakia and India. They are all interested in adapting new and proven rehabilitation technics and methods to their own programs of rehabilitation.

In the coordination of VA Physical Medicine and Medical Rehabilitation with programs for civilian rehabilitation, I am confident that this interest will continue to grow as further refinements in technics are accomplished and as research data are obtained substantiating these scientific improvements in our methods. The reason for such widespread interest is that not only does medical rehabilitation pay off economically in getting the individual back to his family and a job in the community, but actual hospitalization time is shortened and hospital readmissions are reduced.

In addition, an effective program of this type opens up urgently needed beds for acutely ill patients. And, perhaps most important, an opportunity exists for those severely disabled veterans, who otherwise might be committed to permanent hospitalization for the remainder of their lives, to be motivated, retrained and reoriented for a useful, productive place in society.

MEDICAL REHABILITATION IN A CRIPPLED CHILDREN'S HOSPITAL *

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The realization of what a well organized medical rehabilitation program meant to the thousands of sick and wounded in the military hospitals during the last war is one of the most vivid and pleasant memories many of us have of our army experiences. The tremendous boost in patient morale for which these programs were responsible and the number of badly handicapped persons restored to normal living by these programs, cannot be estimated. During the last war I had an unusual opportunity to observe and participate in the over-all planning of certain parts of these programs for the Army Air Forces hospitals. I came out of the service with many mixed feelings about certain phases of military medicine, but there was nothing mixed in my thoughts concerning the great value of mental and physical reconditioning for the military patient. One of the first questions I asked myself upon returning to my former civilian position was what part or parts of these military programs of rehabilitation could be adapted to civilian medicine and particularly to the care of the crippled child. Some of my ideas on the subject and what has been actually worked out in the institution with which I am associated, the Alfred I. du Pont Institute, of Wilmington, Del., forms the basis for this discussion.

Introduction

First, what is the objective of the treatment of a crippled child? It is to create in this child the best possible physical and mental state for future normal function in all conditions of life. Some may say that this is the objective for the treatment of the crippled adult. It is, but for the child it is more important, for too often the adult cripple is the result of childhood neglect. And there is no truer statement than "Just as the twig is bent, the tree's inclined." For this reason, in the planning of a children's medical rehabilitation program attention should be given to every phase of the child's development, both mental and physical. It may be thought by some that the planning for a child's mental development by the rehabilitation service is unnecessarily extending the field of rehabilitation into education. It is true that the field is being extended but not unnecessarily so, for the education of a handicapped child is as important a part of rehabilitation as the physical restoration. A successful plan must be based on the treatment of the child as a whole — i. e., the mind as well as the body. These should always be linked together, planned together and integrated into one program.

The physical part of rehabilitation is divided into (1) physical conditioning; (2) physical therapy, including corrective exercises, and (3) occupational therapy. The mental part is divided into (1) academic, (2) vocational and (3) religious education. A combination of the physical and mental parts is recreational therapy, which, too, has an important place in this program.

Physical Rehabilitation

Physical Conditioning. — The type and extent of a program for physical conditioning, with its setting-up exercises, necessarily will depend upon the

* Read at the Seminar on the Progress of Physical Medicine, New York Polyclinic Medical School and Hospital, Dec. 1, 1947.

handicap. In general, crippled children in a conditioning program can be grouped according to the area of the body involved in the disability, such as the back, the hip, the foot and the upper extremity. As far as possible all exercises should be given to children in groups rather than to the individual child. They may be given on the ward, in or out of bed; in the therapeutic gymnasium, on or off a mat, or in the therapeutic pool. The exercises should be accompanied with music because with its rhythm and swing they are less boring, less like work, less tiring and always more effective. The exercises can be planned for all the muscles not confined in apparatus or splints. For example, for a child in a right hip spica the exercises should include the muscles involved in moving the neck, shoulders and arms and left hip, knee, ankle and foot.

It has been the policy in our institution in the last year to teach each child how to swim before he leaves the hospital. This is done with group swimming instruction in the indoor pool in cold weather and the outdoor and indoor pool, in warm weather.

The difference this simple reconditioning program has made in the general health of the children is most striking. There are better appetites and more constant increases in weight. What is particularly gratifying is that, when the child first starts to become ambulatory after being in bed or plaster, the muscles usually have good strength and tone, crutches and braces can be used sooner, walking comes faster and the period of convalescence in the hospital is definitely shortened.

Physical Therapy. — The physical therapy for crippled children is basically heat, massage, stretching and corrective exercises. In our hospital, the heat is obtained principally from the infra-red lamp. However, we use also the paraffin bath for hands and feet and occasionally for elbows, especially of a child with rheumatoid arthritis. There is a definite place for the whirlpool bath as a source of heat and cutaneous stimulation. There is little need for diathermy in the young child, although occasionally in the older child it may be of value. The heat should be followed by massage, active and passive exercises and stretching as indicated. The stimulation of muscles by galvanic and faradic current in either partial or complete paralysis is very often an aid in diagnosis as well as useful in treatment. This we employ rather frequently.

Corrective exercises or muscle reeducation forms one of the most important parts of physical therapy for the crippled child; for example, a patient with torticollis, both before and after operation, always needs special exercises for the development of strength in the muscles opposite to those which are affected. Certain types of lateral curvature of the spine can be materially helped by corrective exercises. In the knee, the quadriceps muscle and, in the shoulder, the abductor muscles are frequently weak, and special exercises are needed to return their tone and strength to normal.

The De Lorme resistive exercises have a definite place in this program of corrective exercises. We have found these to be of value in restoring normal function to weak extensors of the knee. The use of resistive exercises to increase muscle strength in the paralyzed muscles of anterior poliomyelitis has not yet been employed in our institution. However, I believe that this therapy ultimately will have a place in the treatment of poliomyelitis.

Corrective exercises can often be given in the water of a warm therapeutic pool with more effective results than exercises given out of the water. The fascination and pleasure to the child of being in water and his willingness to work harder in this medium make it possible oftentimes for him to contract muscles and carry out exercises he will not do otherwise. If not overdone,

this increased effort is one of the great advantages of pool therapy; however, I am sure that there may be considerable psychotherapy involved in this form of treatment. Care must be taken not to overdo the underwater exercises, for there is no doubt that many patients with infantile paralysis have become worse with too strenuous and frequent exercise in water.

The physical therapist, in addition to her knowledge of the use of the commonly employed modalities of physical therapy, should have a knowledge of the principles of bracing. Too often, owing to ignorance on the part of the technician, errors are made in the removal and application of braces and splints at the time of physical therapy treatments. If the technician understands fully the purposes of the appliance, these mistakes may be avoided. In addition, she should have knowledge of the more frequently encountered psychosomatic disorders of bones and joints, know how to recognize the cardinal symptoms in her patients and report these to the physician. This may obviate long periods of useless physical therapy and materially aid in the ultimate recovery.

Occupational Therapy. — Occupational therapy should, whenever possible, form a major part in the program of medical rehabilitation and should not be confused with vocational education. At the present time, very few crippled children's hospitals have a good occupational therapy department which has been integrated with the medical care of the patient. Occupational therapy for the orthopedic patient should be planned entirely around the physical handicap. It should not be for diversional or entertainment purposes. It should be planned always in association with the physical therapy. It is particularly valuable for disabilities of the upper extremities, especially of the hand and the shoulder. It has been said that for an adult the most valuable type of occupational therapy is that which involves the use of tools to which he has previously been accustomed. This obviously cannot be true for a crippled child. However, hand sewing, loom work, drawing and the like are interesting to the child and are valuable forms of occupational therapy for the upper extremity. For the lower extremity, the use of the foot pedal-operated sewing machine, jigsaw and the like are excellent.

The occupational therapist should be fully acquainted with the disability and the objective of the treatment. In a well planned program there should be frequent conferences between the occupational therapist, physical therapist and physician. Expensive equipment is not necessary for effective therapy. However, the equipment should be carefully selected and planned for work with the disabilities most frequently found in a crippled children's clinic.

Mental Rehabilitation

The next large group of activities in a well rounded program of medical rehabilitation is that which involves the mental development. It has been said by a well known physician that "class room education goes hand in hand with physical training." This should always be true. The development of the mind should include academic education for the younger child, academic and vocational education for the teen age child and religious education for all.

Academic Education. — For academic education, as far as possible, the children should be grouped in schoolrooms in beds, in chairs and at tables. It should not be bedside instruction in wards if it can be arranged otherwise. Children like and need association with other children in a school room. It is always wise to have the same type of academic education in the hospital school as is employed in the local, state or city, school system. In our Institute, the teachers are employees of the Institute but are recommended and approved by the Delaware State Board of Education; the same textbooks

are used as are used in the state schools. The children coming from schools of Delaware are continued in the same grades as they were in their home schools. When the child leaves our school on discharge from the hospital, a report on his progress is sent from our school teacher to his home school teacher.

In the management of the education of the crippled child it is important for the teacher to have imagination; she must have an ability to appraise what the child's mental capacities are and plan accordingly. There is no impairment in mental powers in the average crippled child. If there is a lack of normal mental development, it is, in most cases, not real but only apparent, because the child has been denied the advantages of a normal education.

In our hospital during the past year we have had a junior and senior school teacher and 72 children in the school for periods varying from a few weeks to the whole school year. All but 2 of these 72 children were passed to the next higher grade. What the passing record for a similar group of normal children would be, I do not know; but I doubt that the percentage would be higher.

Vocational Education. — The vocational education of the child cannot be started before the thirteenth or fourteenth year. In the crippled children's hospital of smaller size — i. e., under 150 patients — this is not a practical program. However, in the hospitals with over 150 patients, especially those in which most of the children are from 14 to 18 years of age, there should be established a program of vocational training with especially equipped schoolrooms and shops similar to that of a modern vocational high school. There should be very careful examination of the child's aptitudes in order to select the best vocation. Very often a child may choose a vocation which he could not adequately perform because of his handicap; in this case there should be an adequate period of vocational testing. Usually it is always possible to find a vocation which a handicapped child can be started in during his period of hospitalization. For a successful program the average stay of the child in the institution must be a year or longer. In many institutions much of the vocational training may center around occupations pertaining to the operation of the institution, such as work in the hospital maintenance shop, the hospital laundry or even outside work on a farm. This type of vocational education — in which the child is in association with paid workers, some of whom may be handicapped, and is not completely on his own — is extremely practical and often shows him how he will later fit into society and become self supporting. Every hospital should employ the handicapped wherever possible.

Religious Education. — The third part of the educational program is religious education. In our hospital, which now has an average daily census of 55 patients, the Protestant churches have services for their children once a week, a different church being responsible for the service each Sunday. For the Catholic children, a priest holds a weekly mass, and, for the Jewish children, a rabbi holds a service bimonthly. In addition, there is a church school class for the Protestant children lasting one hour one afternoon a week. Another religious feature is that grace is said by one of the children before each meal in the dining room of the ambulatory patients. It is my feeling that this type of religious educational program — small though it is — gives something to the child which he will not easily forget, and, if the child comes from a religious family, it definitely will give him a feeling of increased confidence in what he has been taught at home.

Recreational Therapy

A recreational therapy program should be developed in all crippled children's hospitals. In the military hospitals during the war

the Red Cross carried on a very extensive and valuable program of recreation for the soldiers and sailors. There is a great deal of this military program which is definitely applicable to the care of the crippled child in an institution. This therapy is a combination of the physical and mental. There is a great deal of time during the summer, over the week ends and in the evenings which could be very profitably spent by the child in a program of planned recreation. There should be a trained recreational therapist in charge of this program. The activities should include all forms of games and sports which can be carried out, such as soft ball, basketball and croquet. This should be coordinated with the program of physical conditioning. Story telling and reading should be planned by the therapist. Taking the children into the woods in their wheel chairs and on their crutches for nature study classes has been found to be extremely popular and worth while with our children. Picnics are always exciting. We are fortunate in having an old barn close to the hospital which has been fixed up as a recreation building. In this there is a fireplace for wiener and marshmallow roasts and tables for table tennis, card games, etc. In addition, movies are presented to the children once a month during the winter. There are always shows and entertainments given by the local Junior League, schools, churches and other groups. This entertainment should be carefully planned. It is available in any community if it is looked for by the therapist in charge of the program.

Achievement Tests

An achievement test program should be established in all hospitals primarily planned for long term care of the handicapped. It is at the present time the only satisfactory method of determining functional physical capacity of the handicapped. These tests, which should include the performance of all normal daily activities, furnish the best available guide for therapy. The program may be definitely the keystone to the patient's major activities, and in many cases it furnishes the real stimulus to recovery. These tests proved of tremendous value both in the rehabilitation centers and in the military hospitals during the last war. They have perhaps best proved their value as an incentive for accomplishment to the paraplegic patients. The achievement test records may present both the types and the extent of the physical disability as well as the mental capacities. As the patient's achievement test score increases, the progress of recovery can be charted, and often times there can be obtained from this record an appraisement of the future functional capacity for normal living of the handicapped child.

Conclusion

The program of medical rehabilitation in a crippled children's hospital which I have briefly presented may seem to many to be too idealistic. Perhaps it does represent an ideal, but it is certainly an ideal which everyone should be striving for in the organization and work in the institution for the handicapped child. The program must be well planned and coordinated with the other medical work of the institution and preferably should be under the direction of a full time administrator of medical rehabilitation.

Kessler has said that "potentialities of great performance lie within us all." This is extremely true; it should be the duty of the rehabilitation worker to do all possible to develop these potentialities in the handicapped. No better way can this be done than through a comprehensive program of medical rehabilitation, and perhaps then the best possible physical and mental state for normal function in all conditions of life will be a reality for the greatest number of crippled children.

A NEW MOBILE SITZ BATH CHAIR

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CHARLESTON, W. VA.

I have found the sitz bath the method of choice in postoperative care of the perineum, both surgical and obstetric. It has long been used for medical and postoperative care of patients with rectal, genitourinary or pelvic diseases, with coccygodynia or with pelvic and perineal discomforts. The increasing evidence in the literature of advantages of early postoperative and postpartum ambulation makes this method desirable after perineal repair. In the past, sitz therapy has been handicapped by certain disadvantages. In many hospitals the patient had to be taken to the opposite end of the hall to be placed in a regular bathtub, and time was lost thereby. Furthermore, nurses were scarce and hospital beds were filled to capacity. In addition, many a newly postoperative or postpartum patient would exhibit a psychologic resistance to getting into a bathtub.

Cognizant of these drawbacks but long convinced of the efficacy of the sitz bath in postoperative and postpartum perineal care, I devised a mobile sitz bath chair to facilitate the procedure.

Apparatus

The chair frame is sturdily built of aluminum alloy tubing, and is supplied with large caster rollers to make it quickly and easily available at the patient's bedside. It is designed with a broad base, and a specially designed basin is tilted for the patient's comfort. A suspension seat is curved to fit the buttocks and has an adequate opening to avert pressure on the painful areas. These features make it possible for the patient

Mobile sitz bath chair.

to feel relaxed while taking the sitz bath. The basin holds the fluid into which the metal seat dips, and an electric heater keeps the solution at tolerance heat until the patient is ready to use it. Both the stainless steel basin and the suspension seat can be removed for easy cleaning and sterilizing. A regular bath towel, placed over the seat and changed for each treatment, minimizes the laundry problem. The basin is quickly filled to the required (marked) level by using the special syphon tubing, which is connected to a regular water spigot. When the treatment has been completed, the suction portion of the tubing is attached to the same spigot and the fluid removed from the basin without detaching it from the chair.

Comment

This chair makes sitz bath therapy more readily available. The indications may be summarized as follows:

I. Genitourinary
  A. Medical
    1. Prostatic infection
    2. Lower urinary tract infections in general
    3. External genital lesions
    4. Relaxation of bladder sphincter
  B. Surgical
    1. Postoperative care
II. Traumatic surgery
  A. Wounds at or near perineum
III. Proctology
  A. Medical
  B. Surgical
    1. Postoperative care
IV. Gynecology
  A. Medical
    1. Pelvic inflammations
    2. Perineal inflammations
    3. Cutaneous lesions
  B. Surgical
    1. Postoperative care of perineum
V. Obstetric
  A. Postoperative care of perineum
VI. General
  A. Sciatica
  B. Coccygodynia
  C. Neuroses (special cases)
  D. Functional disorders (special cases)

The sitz bath may be taken one to three times a day for twenty to thirty minutes, according to the need. Hypertonic salt solution (2 oz. of coarse salt to the basin of water) with added acetic acid (2 oz. of vinegar) makes a particular effective bath for care of the perineum.

A number of objections to the sitz bath as a postoperative procedure have been suggested: (1) the possibility of infection from bathing a fresh operative wound and the rectum in the same solution; (2) possibility of infection ascending into the pelvic organs; (3) disruption of the wound; (4) displacement or prolapse of the uterus because of the early rising. All the potentially unfavorable reactions were borne in mind, and careful case records were kept. Not only did the unfavorable reaction not occur, but favorable effects were noted in all cases; better wound healing, fewer temperature elevations and prompt healing of tissues.

For sitz bath therapy, the mobile bath chair has proved itself of great practicability because of its convenience, simplicity, comfort and effectiveness.

MEDICAL NEWS

Research Program at Saratoga Spa

Results of a study of the Saratoga Spa and its facilities for mineral water therapy are to be used in the teaching of physical therapists and medical students in the Baruch Center of Physical Medicine at the Medical College of Virginia.

Dr. Frances A. Hellebrandt, Director of the Baruch Center of Physical Medicine of the Medical College of Virginia; Dr. Ellen Neall Duvall, Research Associate, and Miss Sarah Jane Houtz, research assistant of the center, have arrived at the Saratoga Spa for a month of study.

Dr. Hellebrandt is initiating preliminary experiments at the Washington Baths in the use of the naturally carbonated mineral waters as they affect the functions of the human body and is making preliminary studies of circulatory response to the naturally carbonated mineral water baths.

American Occupational Therapy Association

. The 31st annual convention of the American Occupational Therapy Association will be held at the Hotel Pennsylvania, New York City, September 7, 8 and 9, 1948. The annual institute will follow, Sept. 10 and 11. Miss Frieda J. Behlen, OTR., Director, Occupational Therapy Curriculum, New York University, is chairman of the program committee; Miss Marguerite Abbott, OTR., Associate Director, Occupational Therapy Training Courses, Columbia University, is chairman for the round table discussions.

Department of Rehabilitation and Physical Medicine, New York University College of Medicine — Partial Undergraduate Teaching Schedule, 1947-1948

Fourth Year

(Fifteen 1½ Hour Meetings at 11:30-1:00 in G-6 Classroom.)

Rehabilitation in Cerebral Palsy (Demonstration: Film: "A Day in the Life of a Cerebral Palsy Child"). Dr. Deaver, and Staff, March 9.

Rehabilitation in Tuberculosis and Diseases of the Chest (Demonstration). Dr. Donald A. Covalt. Guest: Mrs. Florence Linduff, R. P. T., Chief, Physical Therapy, Veterans Administration, March 16.

Rehabilitation in Poliomyelitis (Demonstration: Film: "Accent on Use"). Dr. Deaver, and Staff, March 23.

Rehabilitation in Cardiac and Peripheral Vascular Disease. Dr. Rusk. Guests: Dr. O. Allan Rose, Department of Medicine, and Dr. Charles E. Kossman, Department of Medicine, March 30.

Rehabilitation in Arthritis. Dr. Rusk. Guests: Dr. Otto Steinbrocker, Department of Medicine, and Dr. Walter McClellan, Medical Director, the Saratoga Spa, April 6.

Rehabilitation in Upper Extremity Disabilities (Demonstration: Film: "The Diary of a Sergeant"). Dr. Deaver. Guests: Dr. Ernst W. Bergmann, Department of Orthopedic Surgery, and Dr. Converse, April 13.

Rehabilitation in Lower Extremity Disabilities (Demonstration: Film: "Swinging Into Step"). Dr. Deaver; Dr. D. Covalt, and Staff, April 20.

Speech and Aural Rehabilitation. Dr. Rusk. Guests: Dr. James S. Greene, Medical Director, The National Hospital for Speech Disorders, and Mr. Moe Bergman, Chief, Aural Rehabilitation Unit, The Ray Clinics, Veterans Administration, April 27.

Rehabilitation Problems in Psychiatry. Dr. Rusk, Guest Psychiatrist. Guest: John Eisele Davis, D.Sc., Medical Rehabilitation Service, VA, May 4

Vocational and Social Problems in Rehabilitation, and the Organization and Administration of a Rehabilitation Service in a General Hospital or Community Center. Dr. Rusk, and Staff, May 11.

New York Society of Physical Medicine

The following scientific program was presented at the regular monthly meeting for February of the New York Society of Physical Medicine: "Clinicopathologic physiology of therapeutic exercise," Hans Kraus, M.D. (by invitation). The discussion was opened by Drs. George D. Whedon and Frederick J. Knocke (by invitation).

Veterans Administration News

A permanent reference exhibit of prosthetic devices, the only one of its kind in the world, has been opened in Room 890, Veterans Administration Building, Vermont and H Streets, N. W., Washington, D. C.

Two important purposes are served by this exhibit: it enables VA prosthetic specialists to analyze features of the various aids and guide veterans in the selection of devices best suited to their needs; it also will aid in elimination of duplication of effort in research work, inventors may learn what has already been developing by visiting the exhibit.

Veterans Administration announced it is distributing three new types of artificial arms to approximately 5,000 amputee-veterans through some 350 artificial limb dealers over the nation. The arms are the first concrete products of an artificial limb research program financed by the federal government.

These arms incorporate a number of improve-

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ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

AN OUTLINE OF THE DEVELOPMENT AND AIMS OF OCCUPATIONAL THERAPY *

Occupational therapy as we know it today is a direct outgrowth of World War I. Early in 1918 Surgeon General Gorgas of the Army requested that training courses be developed to prepare young women to go into Army and Navy hospitals to build up morale and "to keep the patients busy." Such courses were begun as a war measure, with the expectation that they would perhaps be given up after the cessation of hostilities. After the Armistice, however, the demand for trained workers increased, and this demand has continued to grow through the years. The field has expanded greatly and the preparation for the work has become more formalized, so that we are dealing today with a distinct auxiliary medical specialty, a specialty as essential to the practice of medicine as nursing, physical therapy or social work.

One of the early fields of the occupational therapist was found to be the mental hospital. This development is not strange, since in the mental hospital a considerable number of patients are ambulatory and since it had long been recognized by those concerned in the administration of these hospitals that patients were far better off if occupied. We find the writers of a century and more ago advocating work as a therapeutic measure in mental hospitals. With the development of the knowledge of psychologic mechanisms and with the various advances in psychiatric therapy, occupational therapy was soon developed as a valuable auxiliary, again for the purpose not merely of keeping the patient busy but of designedly attracting his attention to certain activities which would be beneficial in the treatment of his particular psychosis.

Another important type of institution to recognize the value of this rising specialty was the tuberculosis sanitarium. Here, again, the morale factor was important, but it was also found that considerable time could be saved for the convalescent patient by developing what might be termed prevocational therapy and developing his work tolerance under the guidance of the physician. Again, it was found in general hospitals, especially on the surgical and orthopedic wards, that the occupational therapist had a considerable contribution to make in applying her technics to the redevelopment of skills and abilities which might have been temporarily in abeyance as the result of the operation or the orthopedic condition. In the process of regaining muscle function, for example, various activities will be adapted by the occupational therapist to round out and complement the work of the physical therapist.

Other types of activities in which the occupational therapist has been found to have a decided value have been children's hospitals, institutions for

* By Winfred Overholser, M.D., Sc.D., Chairman, Consultants on Occupational Therapy, Council on Physical Medicine, American Medical Association, Washington, D. C.

the blind and deaf, penal institutions (especially the defective delinquent departments), child guidance clinics, visiting nurse associations, community health groups and the rehabilitation clinics which are developing rapidly over the country since the recent war. Even five years ago the statistics indicated that there were occupational therapists employed in more than 800 hospitals throughout the country working alongside the nurse, the physical therapist, the social worker and the other members of the various auxiliary professions who combine their special knowledge and experience under the doctor's supervision in order to provide the best of modern care for the sick and the disabled.

In the period up until the outbreak of World War II it was being more generally recognized that the important thing in treatment is not so much the disease as the patient. More and more, occupational therapy was learning mental mechanisms, learning to view the patient as a whole individual, and to adjust various technics of occupational therapy to that particular patient's need — all these, it should be emphasized, under the physician's direction and supervision.

The outbreak of World War II found the supply of occupational therapists hopelessly inadequate for the needs which the Army finally recognized it had for this particular work. As a result, a stimulus was given not only to the development of short courses by the existing schools but to the development of new schools of occupational therapy. There are at the present time twenty-two schools of occupational therapy, all of them connected with colleges or universities.

In one respect occupational therapy has differed from its colleague and ally, physical therapy. The physical therapist had worked much more closely with the physician, particularly the orthopedist, in the application of physical procedures to the patient. This has been noticeably not the case with occupational therapy. It has been, so to speak, something of an orphan, recognized by a considerable number of specialists, especially in the psychiatric, orthopedic and tuberculosis fields, but still somehow not quite of full stature.

In the final maturation of occupational therapy the American Medical Association played an important part. In 1945 the Council on Physical Therapy of the American Medical Association changed its name to the Council on Physical Medicine and established an advisory committee on occupational therapy. In about 1939 the Council on Medical Education and Hospitals set up standards for the approval of schools of occupational therapy, as it had already done for the schools of physical therapy. Thus there was at last full recognition by the American Medical Association of the fact that occupational therapy was an integral part of physical medicine, that it was entirely comparable with physical therapy and on the same footing. The value of this recognition is obvious; occupational therapy is a profession, a valuable auxiliary to medicine, one which is closely linked with physical therapy and which is in all respects a colleague of the other auxiliary medical disciplines. The specialist in physical medicine or the orthopedist or the physician in the mental or tuberculosis hospital writes a prescription for occupational therapy indicating the needs of the patient and what is expected, just as he would write a prescription for a drug or for the application of diathermy or some other physical modality.

An additional widening of the horizon resulted from the work done in World War II, particularly under the stimulus of Drs. Howard Rusk and

Donald Covalt, in developing early ambulation and other valuable rehabilitation procedures designed to get the soldier back as a fighting man as rapidly as possible. To this work they summoned not only the occupational therapists and the physical therapists but recreational workers nad specialists in physical education. As a result, occupational therapy has added various educational programs, types of recreational activity and simple industrial projects to its armamentarium. Furthermore, this rehabilitation work of Rusk and Covalt not only is being continued in the Veterans Administration hospitals but is being developed in the various industrial clinics and the rehabilitation clinics which are now being set up in various parts of the country. The principles, in other words, are fully as applicable to civilians as they are to the armed forces and should result in vast savings in time and productivity to those who have been disabled by sickness or injury.

It can well be seen that the person who is to work alongside the physician and under his direction not only must be one of imagination and tact and emotional balance but must, as well, have a considerable degree of professional knowledge of the nature of disease and the mechanisms of muscle and nerve, bone and joint. The tendency now is to offer a degree course — that is, a five year course which leads to a bachelor's degree in science in addition to the specialized training in occupational therapy. For example, the theoretical teachings includes (1) the biologic sciences, such as anatomy, neurology and psychiatry; (2) the social sciences, such as sociology, delinquency and crime and social agencies; (3) the theory of occupational therapy, covering the principles and practice of occupational therapy in relation to the various special fields, and finally, (4) clinical subjects, such as cardiac diseases, communicable diseases, orthopedic disabilities and tuberculosis.

The growth of the field requires a certain amount of flexibility in technical training, such as therapeutic arts and crafts, educational therapy and recreational therapy (such fields as gardening, dramatics, music, physical education and social recreation). In addition, at least nine months of clinical training are called for in hospitals, with particular reference to mental, tuberculosis, general, pediatric and orthopedic disorders. It is the opinion of those who are familiar with the field that this training is essential if the occupational therapist is to be expected to do the work which she should do; she is not, that is, a rote worker. She must know what she is about and why she is about it. Experience is useful, but without the background of special training it is likely to be applied in a purely routine and unintelligent manner. Unfortunately, the United States Civil Service Commission has not felt itself in a position to require these educational standards, but the tendency will certainly be increasingly toward the appointment only of persons who meet requirements of the sort outlined. The federal government does recognize occupational therapist positions, at least those in which the incumbent has had adequate educational experience, as of the professional grade.

In spite of the fact that a large number of workers in the field were turned out from the brief courses during the war and in spite of the increased number of schools of occupational therapy which have recently been established, there still is a serious shortage of personnel. There is no doubt that the demand will continue to increase, and it is hardly likely to be met by the available supply of occupational therapists in the near future. For a profession which is still less than thirty years old, occupational therapy has reached a flourishing and promising maturity.

THE INSTRUCTION COURSE OF THE CONGRESS

For several years the American Congress of Physical Medicine has conducted an instruction course during its annual session. At the outset these courses dealt with current every-day situations arising in the clinical use of physical medicine. As the specialty was developed, these courses were changed somewhat. An attempt was made to present the basic factors involved in the use of physical agents which would give the physician who was not a specialist in the field, and the therapist, a better understanding. In addition to these items, the handling of the definite clinical problems was discussed. This type of course definitely served its purpose and should continue to do so.

Further development of physical medicine, more extensive research, a greater number of young men specializing and taking examinations from the Board of Physical Medicine changed the demand for the subjects to be presented in the instruction course. It seems wise now to try to change the course so that it would be of greater value to those specializing and still be of use to the general practitioner and the therapist. Therefore, two courses will be organized to be presented at the annual session of the Congress in September, 1948. One course will consist of ten hours of discussion of clinical and basic subjects, valuable to the interested physician and to the therapist, but not to the full-time physiatrist. The other will consist of the same number of hours but will be made more advanced and will consist of lectures and demonstrations in biophysics, including the recent advances in the use of electrical currents and their clinical applications. It will also include new developments in research in physiology as applied physical medicine. The course will be given by outstanding specialists in the field and will be limited to physicians only.

Considerable time and effort will be spent in preparing these lectures and demonstrations. It is hoped that the fine interest shown in the past will continue to be shown in this newly arranged instruction course.

Medical News
(Continued from page 174)

ments that enable amputees to operate them with greater facility and for a wider range of uses than was possible with the former artificial arms.

Amputee-veterans who have permanent and spare arms of the older variety may secure one of the three new types as an additional, or third arm most suited to their needs, provided the appliances can be fitted satisfactorily. They will not receive a hand or hook with the new appliance because the hand or hook of the spare arm may be used on the new units.

Residency Available

There is now available a second year residency in Physical Medicine at the New York State Reconstruction Home, West Haverstraw, New York. This is a rehabilitation hospital especially for the orthopedically handicapped of all ages. There are 310 beds available in the hospital; the average daily census for the past six months has been approximately 200.

Fifty per cent or more of the patients are patients with anterior poliomyelitis; there are between 15 and 25 patients who have cerebral palsy; the remainder of the patients are here for reconstructive surgery and rehabilitation.

It is the present plan to make this a six months' residency for those who have completed a one year general residency in Physical Medicine.

For applications and information, write to Morton Hoberman, M.D., Physician-in-Charge of Physical Medicine and Rehabilitation, Reconstruction Home, West Haverstraw, N. Y.

Malpractice: Osteopathic Manipulation of Fracture

The plaintiff sued for damages alleged to have resulted from the malpractice of the defendant osteopath. The defendant obtained a judgment of nonsuit in the trial court, so the plaintiff appealed to the Supreme Court of California.

On January 4 the plaintiff sustained a fracture of the humerus, and received immediate treatment from the defendant osteopath, in whose office she was employed. After taking an x-ray, he placed her arm in a plaster cast with the forearm in a horizontal position. Infra-red light treatments were administered until January 31, when the cast was cut and further x-ray pictures were taken. On February 3, according to the plaintiff's testimony, the defendant massaged her arm and flexed her elbow about in "all directions" for about ten minutes, and the manipulation caused very definite pain. On February 5 he gave the same manipulative treatment, except that it was more vigorous. The plaintiff said that the defendant massaged her arm and flexed her elbow every few days thereafter, and each of the subsequent treatments was "more violent and longer." During the March 3 or 4 treatment the plaintiff screamed with pain, but the defendant did not stop. On March 14 the defendant, with the assistance of another doctor, gave the plaintiff an anesthetic and extended and straightened her arm to the full 180 degree angle. A few days later he swung her arm while she was holding a weight, and the pain was so intense she "couldn't stand it.'" On March 24 she again returned to his office and "screamed" from pain when her right hand was extended above her head. Following this last treatment the plaintiff secured another doctor.

The defendant testified that he did not give the first manipulative treatment until six weeks after the arm was fractured. When asked whether he had continued to manipulate the plaintiff's elbow after she complained of pain, he replied: "No, I do not manipulate the joint of that kind. We use what is known as the manipulation to tolerance, and that is the point at which the patient begins to complain." He stated that if the manipulation was carried beyond that point "there would be danger of doing injury to the bone which had been fractured." He was then asked: ". . . is it necessary, then, in treatment of a fracture of this type to be very careful about the manipulation of the joint beyond tolerance?" and replied, "That is correct." To the question, "In addition to being brutal, that would be bad practice, wouldn't it " he answered "Yes."

In passing on the propriety of a judgment of nonsuit, said the Supreme Court, every favorable inference and presumption fairly arising from the evidence and tending to sustain the plaintiff's case must be accepted as true. When the plaintiff's evidence, the court continued, is considered in the light of these factors, it is apparent that she has established a prima facie case of negligence. A physician, said the court, is required to have the degree of learning and skill possessed by physicians of good standing practicing in the same locality. Although the defendant did not expressly refer to the practice followed by other doctors in the community, he did testify as to what was proper practice, and it is reasonable to infer that his testimony was based on the standard of care used by physicians in the locality. If he failed to conform to the proper practice as set forth in his own testimony, he did not act as a reasonable physician should under the circumstances. The evidence would have supported findings that the first manipulation treatment was given on February 3, about four weeks after the fracture, that four others were given within six weeks of the accident and that, despite the plaintiff's protests and repeated declarations of pain, the manipulation was carried beyond the point of tolerance. The Supreme Court therefore concluded that a jury could have found that the defendant was negligent in departing from the standard of care required. The judgment of nonsuit in favor of

the defendant was accordingly reversed. — McCurdy v. Hatfield, 183 P. (2d) 269 (Calif., 1947). —J. A. M. A. 135:1169 (Dec. 27) 1947.

Recess Appointments

The Surgeon General of the Army, Major General Raymond W. Bliss, announces that the President of the United States has nominated for appointment in the Women's Medical Specialist Corps, Regular Army, the following physical therapists whose names appear on the third list of appointees in this new corps: Barreras, Angela; Cartwright, Helen M.; Clevenger, Ruth S.; Cole, Olena M.; Conlon, Marcella; Ehlers, Christine D.; Heltman, Grace McNee; Jones, Elizabeth Catherine; Kemske, Dorothy; Kuraner, Elsie; La Porte, Ophelia M.; Lura, Edna; Marshall, Eleanor; Naranche, Dolores W.; Perta, Mary A.; Shockey, Savinah; Rizzo, Corrine C.; Steele, Mada; Summy, Ruth; Underkofler, Audrey A.

Research Fellowships in Medicine

The American College of Physicians has awarded six Research Fellowships in Medicine for the year beginning July, 1948, with stipends ranging from $2,200 to $3,200. Recipients and their fields of research are: Drs. Charles G. Campbell, Montreal, Canada, for studies of the basic physiology of certain cardiovascular problems, at McGill University Faculty of Medicine, Montreal; Frank H. Gardner, Boston, the mechanism and clinical application of the osmotic fragility test, at Thorndike Memorial Laboratory; Samuel P. Martin, Durham, N. C., bacterial metabolism, in the Rockefeller Institute for Medical Research, New York; Peritz Scheinberg, Miami, Fla., cerebral circulation and peripheral vascular flow in normal and hypertensive persons, in Duke Hospital, Durham, N. C.; Lutfu L. Uzman, Istanbul, Turkey, islolation and characterization of brain proteins and their role in health, disease and senescence, at McLean Hospital, Waverly, Mass.; John M. Weller, Hines, Ill., ionic patterns of the intracellular fluids and their influence on enzymatic reactions, at Harvard Medical School, Boston.

Experiment in Cardiac Rehabilitation

The Altro Work Shops, Inc., established thirty-two years ago under the direction of Mr. Edward Hochhauser and his associate Miss Celia Hentell for the rehabilitation of the tuberculous, has undertaken a two year experiment in the field of cardiac rehabilitation of the tuberculous. The facilities of Altro have been offered only to the quiescent or arrested tuberculous patient, for whom it helps to bridge the gap between hospital care and complete social integration. Case histories, including medical, industrial and social work data, together with other factors in the program will be evaluated at the end of the two year experimental period to determine the future content of the program. For the initial stage of the program only 20 patients will be admitted to facilitate the study of their progress. Inquiries and applications should be addressed, with the medical abstracts, to Altro Work Shops, Inc., 71 West Forty-Seventh Street, New York.

Journal for Paraplegics

The Paraplegic Branch of the British Legion announces the publication of a new quarterly journal, the Cord, to be devoted to the interests of paraplegics; it will provide information about appliances and medical treatment and how they are to be obtained. General problems of housing and employment will also be discussed. A prize of $8.50 is offered quarterly for the best short story submitted by a paraplegic reader. The annual subscription is only 50 cents. The journal may be ordered from the editor, Paraplegic Branch of the British Legion, Stoke Mandeville Hospital, Aylesbury, Bucks, England.

Mississippi Valley Medical Society to Meet in Springfield, Ill., Sept. 29, 30, Oct. 1, 1948

The 13th Annual Meeting of the Mississippi Valley Medical Society will be held at Springfield, Illinois, September 29, 30, October 1, 1948, under the presidency of W. O. Thompson, M.D., F.A.C.P., of Chicago, Professor of Medicine, University of Illinois.

Mississippi Valley Medical Society 1948 Essay Contest

The Eighth Annual Essay Contest of the Mississippi Valley Medical Society will be held in 1948. The Society will offer a cash prize of $100, a gold medal, and a certificate of award for the best unpublished essay on any subject of general medical interest (including medical economics and education) and practical value to the general practitioner of medicine. Certificates of merit may also be granted to the physicians whose essays are rated second and third best. Contestants must be members of the American Medical Association who are residents of the United States. The winner will be invited to present his contribution before the Thirteenth Annual Meeting of the Mississippi Valley Medical Society to be held in Springfield, Ill., Sept. 29, 30, Oct. 1, 1948, the Society reserving the exclusive right to first publish the essay in its official publication—the Mississippi Valley Medical Journal (incorporating the Radiologic Review). All contributions shall be typewritten in English in manuscript form, submitted in five copies, not to exceed 5,000 words and must be received not later than May 1, 1948. The winning essay in the 1947 contest appears in the January, 1948, issue of the Mississippi Valley Medical Journal (Quincy, Illinois).

Further details may be secured from Harold Swanberg, M.D., Secretary, Mississippi Valley Medical Society, 209-224 W. C. U. Building, Quincy, Ill.

Southwestern Medical College

A research project in radioactive materials is being inaugurated at Southwestern under the direction of Dr. Allen F. Reid, head of the Department of Biophysics. Dr. Reid also will work with the Buchanan Blood Bank at Baylor Hospital, under Dr. J. M. Hill.

Dr. Allen F. Reid is associate professor and chairman of the department of biophysics.

National Organization Leaders Meet to Stimulate Employment of Handicapped

Millions of the nation's handicapped may soon get the break they have been waiting for. Plans are now underway to mobilize the great organizations of America behind a campaign of cooperation with federal, state and municipal agencies and groups working for the rehabilitation and employment of the handicapped.

On November 4 the Secretary of Labor, Mr. Schwellenbach, invited many civilian leaders to meet in Washington to consider plans for a cooperative and coordinated effort to place the nation's employable handicapped in suitable work. Members included presidents of the Chamber of Commerce, CIO, AF of L, National Association of Manufacturers, top leaders of many large labor unions and farm groups, newspaper editors, radio network presidents, and executives in fraternal, religious, medical, welfare, veterans', women's organizations.

New York Junior League Presents Demonstration

On December 1, the New York Junior League presented Dr. Howard A. Rusk, Professor and Chairman of the Department of Rehabilitation and Physical Medicine of New York University College of Medicine and head of that department of Bellevue Hospital. He reported on the first six months' operation of the demonstration program for disabled civilians at Bellevue. Dr. Rusk was assisted in the presentation by several patients and the Director of Volunteers.

Raytheon Microtherm Acceptable

The Raytheon Microtherm Model CMD4 generates a beam of high frequency radiofrequency energy (radar) for the purpose of locally raising the temperature of soft tissues of the human body. It is housed in a portable box, or case, which can be set on a table. The over-all size is 39 by 24 by 16 cm. (15⅓ by 9½ by 6½ inches), and the weight including the 10 cm. cup-shaped director is 16 Kg., or 36 pounds.

The investigator considers it essential that users of the device be cautioned in this regard. In fact, this danger is to be anticipated as a corollary to the highly desirable relation between cutaneous and internal temperatures which permits adequate internal heating without irritation to the normal skin. For a given degree of cutaneous irritation, the rise in temperature produced in the deeper tissue by the microwaves is much greater than that produced by the radiant heat from an infrared lamp.

The Council on Physical Medicine voted to include the Raytheon Microtherm in its list of accepted devices.

Army Surgeon General Announces Improvements in Advanced Training for Medical Officers

Major General Raymond W. Bliss, Surgeon General of the Army, today announced adoption of a number of changes in the Army Medical Department graduate professional education program for the coming year based on a thorough study of nine months operation of the program and surveys made by nine teams of civilian medical experts. The innovations, effective immediately, are designed to maintain the quality of patient care and to elevate the caliber of training at Army general hospitals.

Honor Kessler and Hudson

Henry H. Kessler, M.D., and Holland Hudson, President and Secretary-Treasurer of the National Council on Rehabilitation, respectively, were named by unanimous decision as the persons who have contributed most toward the aid of the nation's physically handicapped at the National Rehabilitation Association's Annual Convention.

Hearing

There are between 15,000,000 and 20,000,000 people in the United States who are hard of hearing to some extent in one or both ears — 5,000,000 to 8,000,000 have serious hearing defects — 600,000 are using hearing aids . . . approximately 3,000,000 to 4,000,000 need hearing aids — 3,000,000 children have impaired hearing — 40,000 veterans of World War II have lost some or all of their hearing. In twenty years, the Veterans Administration estimates that 300,000 more veterans will be hard of hearing. These statistics indicate the seriousness of the hearing problem.

National Society for Crippled Children and Adults

New developments in the treatment and care of handicapped children were demonstrated at the annual convention of the National Society for Crippled Children and Adults, held in Chicago, November 3 through 5.

Special emphasis was placed on the rehabilitation of the crippled and handicapped.

Convention speakers included Dr. George B Stoddard, speaking on the educational aspects of rehabilitating the handicapped; Dr. Ray Carhart, on oral rehabilitation; Dr. David Slight, on the psychologic aspects of rehabilitation; and Dr. Meyer A. Perlstein, authority on cerebral palsy.

Other nationally known speakers on the convention program were Dr. Arnold Gesell, Dr. George Deaver, and Dr. Howard A. Rusk.

BOOK REVIEWS

HISTORY OF MEDICINE. A CORRELATIVE TEXT, ARRANGED ACCORDING TO SUBJECT. By *Cecilia C. Mettler,* A.B., Ed. B., A.M., Ph.D. Late Assistant Professor of Medical History, University of Georgia, School of Medicine, and late Associate in Neurology, College of Physicians and Surgeons, Columbia University. Edited by *Fred A. Mettler,* A.M., M.D., Ph.D., Associate Professor of Anatomy, College of Physicians and Surgeons, Columbia University. Cloth. Pp. 1215, with 16 illustrations. Price, $8.50. Philadelphia: The Blakiston Company, 1947.

Mettler's History of Medicine presents many original features, most especially important of which are the full translations from original sources illustrating the most important works of the Greek, Latin, and Arabic authors. While the standard medical histories contain references to the work done by these ancient fathers of medicine, they are usually simply brief statements and not translations of the original writing of the author. Dr. Mettler carried this method of translation down to modern times. It shows not only her profound knowledge of the original from which she quotes but also the insight with which she picked out the most essential features of their labors.

The book contains many references of interest to those specializing in physical medicine, "The name of Aloysio Luigi Galvani (1737-1798) of Bologno invariably presents itself when early work in electrophysiology is discussed, but significant activity in this field actually goes back an additional half-century or more to the discovery of the Leyden jar.

E. G. von Kleist of Cammin, Pomerania, is usually credited with the discovery of the Leyden jar in 1745. His work was repeated the following year by Andreas von Keil (Cunaens 1660) and Pieter van Musschenbroek (1692-1761) at the University of Leyden, whence the term. Even before this time many experiments in which electrical stimulation was used on animals and on paralyzed individuals were tried and reported in the current journals. Johavan Gottlob Krueger (1715-1759) noted that an electric shock causes contraction in a normal person and wondered whether it might not be employed in paralyses. Antoine Louis, (1723 - 1792) Secretary of the Academy of Surgeons at Paris, similarly employed the Leyden jar to produce activity in paralyzed muscles in 1747, and Louis Jallabert (1712-1768) of Geneva did likewise in 1748. Robert Whytt had stated in his treatise, mentioned above that electrical stimuli were more forceful than the will in exciting muscular contraction and thought electrical therapy was useful in paralysis. Leopoldo Marco Antonio Caldini (1725-1813) Professor of Anatomy at Bologna and probably a teacher of Galvani presented, during 1756, a paper on the insensibility and irritability of some parts of animals at the Institute of Science of Bologna. In this he described experiments with electrical stimuli on muscle-nerve preparations of the frog, the phrenic nerves of a dog and the intestines of frogs. Caldani later wrote, "Indeed a simple electric shock (not an electric spark) which is hardly perceptible to the senses, is of all stimulating agents the most powerful in exciting this irritability. Many additional examples of the employment of electricity as a stimulus could be recounted but it is obvious from what has been said that Galvani was not the first to employ this technic."

This is a history of medicine that is easy-to-read, interesting, and a useful book for reference. It is highly recommended to all interested in medicine.

HANDBOOK OF PSYCHIATRY. By *Winfred Overholser,* A.B., M.D., Sc.D., Superintendent, Saint Elizabeths Hospital, and *Winifred V. Richmond,* B.S., A.M., Ph.D., Late Chief, Department of Psychology, Saint Elizabeths Hospital, Washington, D. C. Cloth. Pp. 252. Price, $4.00. Philadelphia: J. B. Lippincott Company, 1947.

This is a sensible and authoritative discussion of the modern concepts of psychiatry for the layman. Unfortunately, shortly before the manuscript was completed, Dr. Richmond died. Her surviving, co-author, Dr. Overholser, has stated in the preface: "She was a wise and understanding student of human personality, possessed of the gift of presenting facts simply and readibly." Dr. Overholser has completed the book and now offers it to the public "as a tribute to her memory."

The text is well documented, simply worded and carefully prepared. It discusses psychiatry and psychology, psychoanalysis and defects and disorders of the personality. There is a good description of the modern concepts of the causes of mental disorders, and this is followed by a revealing description of the modern hospital for mental diseases and present-day methods of treatment of psychiatric conditions. There are successive chapters on mental defects, psychoses associated with organic conditions, alcohol and its role in the psychoses, psychoses associated with drugs and other toxic agents, psychoses of middle life and old age, the functional psychoses, the paranoias, the psychoneuroses, the psychopathic personality, mental aberrations and war, crime and mental disorder, psychiatric conditions in children and a final chapter on psychiatry and the layman.

The authors have succeeded in their attempt "to present, in a simple and unsensational manner, the elements of the varied types of mental

disease, their causes, symptoms and prospects." The book is highly recommended to the readers for whom it was written, including "the college student, the nurse, the average man or woman who has mentally ill relatives or friends, and perhaps even the practicing physician who has shied at the more technical volumes on the subject."

PRINCIPLES OF OCCUPATIONAL THERAPY. Edited by *Helen S. Willard,* B.A., O.T.R., Director, Philadelphia School of Occupational Therapy and *Clare S. Spackman,* B.S., M.S. in Ed., O.T.R., Director, Curative Workshop, Philadelphia School of Occupational Therapy and Director, O. T. Dept., Hospital of the Graduate School of Medicine, Univ. of Pennsylvania; Asst. Director, Philadelphia School of Occupational Therapy. Price, $4.50. Cloth. Pp. 416, with 46 illustrations. Philadelphia: J. B. Lippincott Company, 1947.

This book, the result of collaboration of more than twenty authors in addition to the editors, will receive wide praise by all reviewers and, indeed, it is difficult to think of a single major criticism of the work. It is indispensable for anyone setting up an occupational therapy department, teaching, or practicing occupational therapy. It is an excellent introduction to the field for any physician or layman. Every person in the field of physical medicine should read this volume and have access to it for reference. Of special value are the paragraphs on activities appropriate to the functional therapy of industrially disabled patients.

The style and exposition set a high standard in a field in which writing is not always uniformly good.

SEXUAL BEHAVIOR IN THE HUMAN MALE. By *Alfred C. Kinsey,* Professor of Zoology, Indiana University; *Wardell B. Pomeroy,* Research Associate, Indiana University, and *Clyde E. Martin,* Research Associate, Indiana University. Cloth. Pp. 804, with 332 charts and tables. Price, $6.50. Philadelphia: W. B. Saunders Company, 1948.

The authors supply facts that never before have been presented with such complete authenticity on sexual behavior. From early childhood through old age this book answers or clarifies an almost innumerable number of sex behavior questions that have been asked for centuries past.

These authors have brought biologic, medical, psychologic, psychiatric and sociologic viewpoints to bear on a problem that involves all five fields. Drawing material from upper level groups as carefully as it does from the more poorly educated and economically lower levels, this survey represents one of the most extensive uses yet to be made of social stratification as a tool for analyzing problems in the human species. No present-day aspect of human biology stands in more need of scientific knowledge and courageous humility than that of sex. This study is the most useful research of its kind ever to be conducted. The frank and undisguised facts were gathered through some 12,000 confidential interviews conducted with full regard for the latest refinements in public-opinion polling methods.

This study provides scientific data, never before available in such extensive scope that throw long sought light on such problems as the extent and development of impotency, relation of pre-marital patterns to subsequent adjustment in marriage, relation of early sexual activity and subsequent capacity in sexual performance; age as a factor in sexual capacity; valuable facts to assist in discussing sexual development and sex education with parents of adolescent and preadolescent children; observations that will better enable the physician to guide and counsel the newly married; a vast material on which to judge what is normal and what is abnormal, including the bearing of sexual activity on physiologic disturbances, data or average frequencies and range of variation in frequencies of marital intercourse.

It also shows factual comparison of biologic factors and man-made regulations in determining the patterns of human sexual behavior; vital facts on the question of sublimation; detail discussions of variance of patterns in sexual behavior according to social level, enabling the doctor to acquire a fuller grasp of the resulting attitudes and thus to deal more understandingly with the patient's individual problem.

This is a valuable reference book for workers in physical medicine.

EXERCISE DURING CONVALESCENCE—A MANUAL OF ADAPTED EXERCISES. By *George T. Stafford,* Ed.D., Professor of Physical Education, University of Illinois. Cloth. Pp. 281, illustrations 36. Price, $4.00. New York: A. S. Barnes & Company, 1947.

This book gives specific information concerning exercises for convalescence. It discusses rehabilitation and reconditioning in the Royal Air Forces and in the U. S. Air Forces of the Navy and the Army; activity during convalescence; rehabilitation in civilian hospitals; therapeutic exercises following abdominal surgery, following amputations, following debilitating illnesses, following fractures; therapeutic exercise in the treatment of heart disturbances, arthritis, asthma, paralysis, and pulmonary tuberculosis.

During World War II the reconditioning and rehabilitation programs of the armed forces achieved excellent results as many patients in the Army and Navy hospitals can attest. Such programs should be available in civilian hospitals as the author outlines in chapter IV, rehabilitation in civilian hospitals.

Physical and occupational therapists will find this book a valuable guide to the exercise-treatment of their convalescent patients. Physicians will find in this book many exercise combinations valuable in the treatment of their patients.

HISTORY OF MEDICAL THOUGHT: An Essay. By *Richard A. Leonardo,* M.D., Ch.M., F.I.C.S. Cloth. Price, $2.00. Pp. 92, with 16 portraits. Froben Press, 4 St. Luke's Place, New York 14, 1946.

This is the third in a series of presentations of medical history by the author; the two preceding

ones were on history of surgery and of gynecology. This essay attempts to show in a concise manner the influence of philosophy on medicine throughout the ages and its responsibility for prevailing medical and surgical conceptions. The author proceeds from early Greek philosophy and its chief figures — Aesculapius, Pythagoras and Hippocrates — on through Roman, Arabian Medieval, Seventeenth and Eighteenth Century philosophy to the unparalleled advancements of the Nineteenth and Twentieth Centuries, when pathological anatomy, diagnosis, evolution, antisepsis and asepsis came into being and such great minds as Virchow, Pasteur, Koch, Lister, Semmelweis and Darwin prevailed. Eighteen full page portraits of many of these historical figures enliven the presentation. The author deserves praise for his zeal in "pegging along" single-handed on a subject which is generally neglected in the United States and the study of which will much widen the horizon and the cultural background of every student and graduate of medicine.

PERIPHERAL VASCULAR DISEASES (ANGIOLOGY). By *Saul S. Samuels,* A.M., M.D., Consulting Vascular Surgeon, Long Beach Hospital, Long Beach, New York; Attending Vascular Surgeon, Brooklyn Hospital for the Aged; Chief of the Department of Peripheral Arterial Diseases, Stuyvesant Polyclinic Hospital, New York; Fellow in Surgery, New York Academy of Medicine; Member of Committee on Surgery, New York Diabetes Association. Second Edition. Cloth. Pp. 85. Price, $2.50. London, New York and Toronto: Oxford University Press, 1947.

In previous years the subject of peripheral vascular diseases was divided indiscriminately among various specialties in medicine and surgery. As a result, insufficient emphasis was placed on the subject as a whole, leading to a confused classification and a correspondingly inadequate presentation. It is only recently that because of the many hitherto unrecognized details of diagnosis and treatment applicable to peripheral vascular diseases, a new specialty has gradually developed. Growing experience in the field of peripheral vascular diseases brings out the necessity of assigning the entire responsibility to one individual, expertly trained in both medical and surgical phases of the subject, if progress in this field is to be made along present lines with a reduction in the number of cases requiring amputation and in the mortality rate. The author of this monograph has for many years done clinical research in the field of peripheral vascular disease and offers a scholarly outline covering all present day aspects; beginning with anatomy, classification and objective signs it proceeds to a concise presentation of the etiology, pathology, symptoms and treatment of the various forms. A full list of references at each section, a good index and a set of interleaved blank pages for notes, adds to the usefulness of the attractively printed volume.

PRIVATE ENTERPRISE OR GOVERNMENT IN MEDICINE. By *Louis Hopewell Bauer,* A.B., M.D., F.A.C.P., Diplomate; American Board of Internal Medicine, Member Board of Trustees, American Medical Association; President, Medical Society of the State of New York, 1947-1948. Cloth. Pp. 201. Price, $5.00. Springfield, Ill.: Charles C. Thomas, 1947.

Abraham Lincoln in 1854 said: "The legitimate object of government is to do for a community of people whatever they need to have done but cannot do at all or cannot do so well for themselves in their separate or individual capacities. In all that the people can do as well for themselves the government ought not to interfere." The question considered in this book is indicated by its title, and it gives the background of the problem; states the facts about the health of the nation; relates the struggle between the opposing forces and finally suggests possible solution to the problem.

This is a book that should be read by everyone in any way connected with the medical profession. It makes clear that there is a group in the medical profession which recognizes the fact that we have a changed social order; that there are deficiencies in our present system of medical care; and this group is striving to keep what is good in our system; discard what is outmoded; develop supplementary methods to remove these deficiencies; and yet keep these methods within the field of private enterprise or what is known as the "American way of life." It makes the reader agree with Lincoln: "the government ought not to interfere."

DERMATOLOGIC CLUES TO INTERNAL DISEASE. By *Howard T. Behrman,* M.D., Assistant Clinical Professor of Dermatology, New York University College of Medicine; Adjunct Dermatologist, Mount Sinai Hospital and Beth Israel Hospital; Associate Dermatologist, Hillside Hospital; Diplomate of the American Board of Dermatology and Syphilology; Fellow of the American Academy of Dermatology and Syphilology. Cloth. Pp. 165. Price, $5.00. New York, N. Y.. Grune & Stratton, 1947.

This monograph offers a concise, alphabetical description of constitutional diseases exhibiting associated skin changes and illustrating many of the latter with some 118 pictures. About half of the photographs come from the collection of Dr. Frank C. Combes of the New York University College of Medicine. This is a noteworthy effort to visualize the long-known association between skin diseases or abnormalities and internal disorders.

PHYSICAL MEDICINE ABSTRACTS

Electromyographic Studies on Cats After Section and Suture of the Sciatic Nerve. James G. Golseth, and James A. Fizzell.

Am. J. Physiol. 150:558 (Oct.) 1947.

Weddell, Feinstein and Pattle using concentric needle electrodes investigated the electrical activity present in mammalian skeletal muscle after denervation by complete crushing of the nerve supply and during the course of nerve regeneration until functional recovery had taken place. From this and later studies, the following facts relative to reinnervation of muscle were evident. There was a steady decrease in the number of fibrillation action potentials prior to the return of motor unit activity, but a few fibrillation action potentials could be recorded in certain positions in the muscle when no detactable weakness could be recorded clinically. There was a cessation of continuous fibrillation immediately before the appearance of nascent motor unit action potentials. Once started, the spread of motor unit activity throughout the muscle occurred quite rapidly, requiring only five to six days in the rabbit, and twelve days in the human being. When no electrical activity whatever could be recorded from a muscle more than a few weeks after nerve injury, severe morphologic changes were assumed to have taken place, e. g., fibrosis. Complete functional recovery did take place in muscles proven to be fibrillating by electromyography for various time intervals after denervation.

An investigation was made concerning the time course of electrical activity in the tibialis anticus muscles of six cats after section and immediate suture of their nerve supply. Fibrillation voltages were recorded throughout the lengths of all muscles for various time intervals following denervation. There was a definite but unmeasurable decrease in the number and frequency of fibrillation voltages prior to beginning motor-unit recovery. There was a decrease in the total number of areas showing continuous fibrillation, but there was no cessation of continuous fibrillation in all areas of any one muscle prior to beginning motor-unit recovery. Electrical silence did not bear a close correlation with either severe morphologic changes in muscle or beginning motor-unit recovery. The motor- unit voltages associated with beginning motor-unit recovery were in all instances of polyphasic wave form.

Complete functional recovery preceded complete electromyographic recovery in all instances. The average rate of reinnervation was 2.61 mm. per day. Complete functional recovery occurred in all muscles even though they were proven by electromyography to be fibrillating for various time intervals after denervation.

Bell's Palsy. Karsten Kettel.

Arch. Otolaryn. 46:427 (Oct.) 1947.

By Bell's palsy is understood an apparently idiopathic peripheral disease of the facial nerve which unfortunately has been called "rheumatic facial paresis" or "paresis nervus facialis 'e frigore'." Little is known about the disease from the standpoint of etiology; so much seems to be clear, however, that "Bell's palsy," which is far from designating an entity, has become a collective diagnosis for all cases of peripheral facial paresis in which it has been impossible to demonstrate a local causation. The lack of knowledge has also left its mark on the discussion of the genesis of the disease, which practically has been confined to theoretic deliberations.

In 1932, however, Ballance and Duel began to operate on patients suffering from Bell's palsy, decompressing the facial nerve by opening the fallopian canal from the stylomastoid foramen to the lateral semicircular canal, their view being that the disease is due to edema of the facial nerve, which is compressed by the inelastic bony canal.

Morris stated that six to eight weeks was the utmost limit for expectant treatment of Bell's palsy which shows no signs of beginning mobility or only slight signs, but he added that if the faradic reaction becomes negative or the reaction of degeneration becomes positive before this period has passed, the decompression must be carried out as soon as possible. Ticke wrote: "In my experience the 85 per cent that recover had never lost their response to faradic stimulation, . . . the 15 per cent who lose their response to faradic stimulation and show no improvement in from six to eight weeks should have a decompression of the facial nerve."

Observations in Electric Shock Therapy. Geo. Rosenberg.

J. Tennessee M. A. 43:365 (Nov.) 1947.

Best results are obtained with patients who are started on their treatment during the first six months after the onset of the illness; however, a small minority of those treated after two years show some degree of improvement.

Other forms of therapy, such are psychotherapy, occupational therapy and recreational therapy are essential to this treatment. The patients are appreciative of the results obtained.

What's New in Peripheral Vascular Disease, Norman E. Freeman.

California M. J. 67:280 (Nov.) 1947.

The field of vascular surgery has expanded rapidly during the past several years. The oscillat-

ing bed is of great help at times with patients who have severe arterial obliterative disease, especially if they have continuous rest pain at night. A small but definite increase in blood flow with the oscillating bed has been demonstrated. This form of treatment has a great advantage in that it works automatically twenty-four hours a day and that there are practically no contraindications to its use. It can be used with benefit even in the presence of infection.

Treatment of Poliomyelitis in the Acute and Convalescent Stages. Physical Therapy and Orthopedic Consideration. Arno David Gurewitsch; Halford Hallock, and Roger J. Dugan.

New York State J. Med. **48**:267 (Feb. 1) 1948.

This discussion of therapy is based on the study of and experience with 552 paralytic patients in the acute and early convalescent stages who were treated from 1942 through 1946 at the New York State Reconstruction Home at West Haverstraw, New York. The following treatment aims are stated. (1) to alleviate muscle pain, muscle shortening and limited flexibility, (2) to develop optimal function of the weakened muscles, (3) to rehabilitate the patient and make him as useful and independent as possible in the face of his handicap and (4) to prevent the development of deformity in all stages of the disease. The authors discuss the use of exercises quite extensively. In a number of instances the authors found dry heat in the form of radiant light or short wave to be fully as effective as moist heat, especially when the pain or muscle stiffness was localized to a relatively small area. As soon as no further improvement of strength in individual muscles can be reasonably expected an attempt is made to retrain as much useful function as possible. Functional occupational therapy, given for the double purpose of recreation and of training of muscles and skills, is used extensively.

Paralysis of the Serratus Anterior Muscle with a Winged Scapula During the Puerperium. A. W. Diddle.

J. Florida M. A. **34**:450 (Feb.) 1948.

There is a report of a case of paralysis of the serratus anterior muscle following labor. The author discusses various treatments. The damaged extremity can be stimulated with a galvanic current. Other physicians have either fixed the scapula to the underlying ribs or to the spine, or have transplanted the subscapular muscle to the shoulder. Sling support, heat in some form and massage have been recommended. Since the end results obtained by operative measures are not always satisfactory, conservatism is usually practiced when trauma is the etiologic factor. Physical therapy and immobilization of the part involved are believed to aid in minimizing the amount of muscular atrophy while the nerve regenerates. Convalescence is prolonged, lasting several weeks or months. The prognosis for a complete recovery is always equivocal.

Low Back Pain from the Orthopedic Standpoint. Hugh T. Jones.

California Med. **68**:57 (Feb.) 1948.

According to the author low back pain is a controversial subject, in which views differ and opinions conflict. For some time the hip joint was considered the source of the sciatica. Later it was the sacroiliac joint, and now it is the lumbosacral joint. Much thought and literature have been devoted to the possible relationship of faulty posture to the syndrome of the disabled low spinal discs. Contracted soft tissues of long standing may interfere with the attainment of anything but a sway back in patients with certain conditions. Also pronated flat feet can be a factor only in a limited way in connection with posture in general. The amount of blame that can, at present, be assigned to faulty posture in the production of protruded discs is still not proved by definite facts. Treatment in general includes rest. Heat and massage have been used through the ages and as a rule mankind in general enjoys warmth and massage of the back. In certain instances it definitely irritates, however, and should not be continued at the expense of comfort. Manipulation has also been used. Too often, manipulation has been carried out empirically without a clear idea of what condition is present and what one hopes to accomplish.

Painful Shoulder in Coronary Disease. A. Schott.

Proc. Roy. Soc. Med. **40**:733 (Oct.) 1947.

Schott points out that in some patients with coronary disease a painful disability of one or both shoulders resembling scapulohumeral periarthritis is the outstanding symptom. If this occurs a short time after an attack of coronary occlusion during which pain radiated to the affected shoulder, the condition may wrongly be considered to be just the usual manifestation of myocardial infarction. The author reports 6 patients with coronary disease associated with a painful disability of the shoulder. Some relationship between these two conditions appears to exist although its mechanism is obscure. No single method of treatment has proved generally successful, and there is hardly a type of physical therapy which has not been suggested. In the acute stage the administration of morphine may be necessary. The arm should be rested in abduction. Manipulation under an anesthetic, which is contraindicated in the acute and subacute stages, is the method of choice and is often curative when limitation of movement persists owing to adhesions. It is suggested that examination for coronary disease of larger numbers of patients over 40 years of age with painful disabilities of the shoulder—especially the left—without obvious cause is desirable in order to establish the frequency and nature of this relationship.